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EDITORIAL.

Oil Palm Factory Control.

A feature of every oil palm estate is the factory in which the freshly harvested fruit bunches are treated for the recovery of the two products for export — palm oil and palm kernels.

Both products, more particularly the oil, are characterised by a high standard of quality, which can only be maintained by treating the fruit bunches with as little delay as possible after harvesting and by careful control of the various intermediate processes through which the material passes. In order to furnish an idea of the rate of treatment it may be mentioned that the transfer of the oil from the palm to the storage tank is complete within 24 hours.

The maintenance of a high standard of quality necessitates the factory being equipped with the latest machinery, especially when it is remembered that with the seasonal fluctuations in the amount of the crop the factory must often work continuously for weeks at a time.

While quality of product must be maintained the question of output is, however, of primary importance, especially in view of the relatively heavy losses of products that may occur owing to the number of separate processes through which the fruit passes, for example, sterilisation of bunches, separation of fruit, expression or centrifugal extraction, purification of oil. Further, as will be realised these losses chiefly concern the palm oil, which is the more valuable of the two products and is also present in the fruit in the larger proportion.

The relatively heavy capital outlay incurred in equipping the factory, the present low prices for oil palm products and the necessity for reducing losses of products to a minimum, to avoid incurring financial loss, necessitate consideration being given to the question of adoption of a system of factory control.

In the article included in the present number entitled " A System of Control for Oil Palm Factories," by Major C. D. V. Georgi, the author outlines a simple system based largely on the results of the investigations carried out in the oil palm factory at the Government Experimental Plantation, Serdang.

Briefly, the system consists firstly in recording the weights or volumes of all materials entering or leaving the factory, secondly in analysing representative samples of all waste products. The author points out that all three operations involved, weighing or measuring, sampling and analysis are of equal importance and must therefore be carried out with corresponding accuracy.

As a result of the various operations a statement can be compiled in which the results of the working of the factory, covering a particular period, may be tabulated.

While a single factory control statement is of comparatively little value, except in so far as it affords a general indication of the efficiency of the process, a series of statements in which details of factory practice for the individual stages are correlated with losses of products will prove of the utmost value to the management in working out the optimum conditions for the whole process, thereby reducing losses to a minimum.

Although the adoption of a system of factory control necessitates the provision of a chemical laboratory and an adequate staff it is shown that in the case of a large estate of 10,000 acres the expenditure would be amply repaid, seeing that with such an estate in full bearing a variation of only one half per cent. in the output of palm oil alone is equivalent at present prices to more than $6,000 per annum.

In conclusion it may be mentioned that, while factory control is new to Malaya, similar systems have long been a feature of technical factory practice in connection with estate crops in other countries. For example, the high standard of efficiency reached in the modern sugar mill as a result of factory control furnishes an excellent example of the value of such a system, which therefore may well be copied by those oil palm estates anxious to maintain the maximum recovery of high quality products.

Poultry in India.

In the June number of the *Malayan Agricultural Journal* an article on Diseases of Poultry with Notes on Poultry Rearing was published, and it was pointed out that interest in poultry keeping had become greatly intensified in Malaya during the past eighteen months, probably largely due to the economic depression.

In the present number of this Journal, an abstract from the Madras Agricultural Journal, entitled "The Poultry Industry of India", is included. It is felt that the information contained in the article will be of interest to Malayan poultry keepers, since it appears that the problems confronting the industry in India in many respects resemble the difficulties experienced in Malaya.

The article gives an interesting account of the steps which have been taken, in India, by the Governments of various Provinces, to improve the condition of the poultry industry. The methods now being adopted in Malaya, with the same object in view, are, to a large extent, on similar lines to those which have been in operation in India since the year 1919.

There is, as yet, a lack of authoritative literature dealing with poultry in Malaya, and until the work which is being fostered by the Department of Agriculture, S.S. & F.M.S., is more advanced, the main supply of available information, must come from other countries where the work has been in progress for a longer period. It must be appreciated that, although poultry problems in Malaya may vary in some respects from those in other countries,

on account of differences in local conditions, there are undoubtedly a very large number of problems common to every country and it is felt that the dissemination of information on such matters is very desirable since it should tend to stimulate interest and enquiry amongst those engaged in poultry rearing.

Gingelly.

The present number of this Journal contains an article by Messrs. J. N. Milsum and J. Lambourne on the cultivation of gingelly. The oil obtained from the seeds of this plant is extensively used, principally by Southern Indians, for culinary purposes and appreciable quantities of seed are imported annually into Malaya where the oil is extracted by Indians in the neighbourhood of the larger towns.

The recent imposition, in the Federated Malay States, of an import duty of 4 cents per pound full duty, and 2 cents per pound preferential duty, is a factor which should tend to encourage the extension of the crop locally, with the object of producing sufficient oil to meet the local demand. It is estimated that in order to replace the amount of the net imports of gingelly into Malaya in 1932 *i.e.* seed 2,708 tons, oil 11 tons, approximately 10,000 acres annually planted with gingelly would be required. This estimate is based on an average yield of 600 lbs. of cleaned seed per acre. The acreage under this crop in Malaya is negligible.

Present market prices for gingelly seed range from $4.50 to $6 per picul according to quality; the return therefore is unlikely to exceed $27 per acre, which would not permit of any profit being made with paid labour, unless gingelly was grown in rotation with a more paying crop. As a rotation crop grown by small-holders gingelly, however, has possibilities since it matures in just over three months from sowing and there is a considerable demand for seed locally.

It is evident that the crop, like all annual crops in the tropics requires soil well supplied with humus and available plant foods if a remunerative yield is to be secured.

A SYSTEM OF CONTROL FOR OIL PALM FACTORIES.

BY

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Introductory.

Factory control may be defined as the collection and analysis of various data regarding the different stages of the particular factory process involved with the object of obtaining the highest efficiency for the whole process compatible with the most economical method of working.

The importance of the adoption of some system of control for any technical factory will be recognised, especially in these days when, as a result of prevailing low prices for products and a consequently narrow margin of profit, financial loss may be incurred, unless a high standard of efficiency is maintained.

An estate oil palm factory forms an excellent example for the necessity of the introduction of a system of control. A relatively heavy capital charge is incurred in the erection and equipping of the factory, the present prices of oil palm products are low, and the fruit passes through a number of processes in which losses of products occur.

In the present paper therefore a simple system of control suitable for adoption in oil palm factories will be outlined for the purpose of bringing to the notice of those interested the details of the procedure necessary for ensuring the recovery of the maximum percentages of palm oil and palm kernels.

From the point of view of factory control, palm oil is more important than palm kernels for the following reasons:

(i) The proportion of palm oil in the fresh fruit is much greater than that of palm kernels,—29 per cent. of palm oil compared with 6 per cent. of palm kernels.

(ii) The unit price of palm oil is more than double that of palm kernels, the present prices being approximately £18 per ton for palm oil, compared with £8 per ton for palm kernels.

In any system of oil palm factory control therefore it will be realised that more attention must be given to a study of the losses of oil compared with kernels, the recovery of which is a simple operation. Further, it must be remembered that owing to the larger number of operations necessary for the recovery of the oil there are increased chances of losses in respect of this product.

Apart from the actual extraction process, a large oil palm factory, dealing with the crop from 10,000 acres or more, lends itself to control from other points of view, for example, steam and power consumption. It is not proposed, however, to deal with these aspects in the present paper, which, as stated previously, will be restricted to a consideration of the factors regarding maximum recovery of products.

General Considerations on Factory Control.

Three essentials are necessary for control in a technical factory (*a*) measurements of either weight or volume (*b*) sampling (*c*) analysis. All these operations are of equal importance, and must therefore be carried out with corresponding accuracy.

Unless, for example, the amount of a particular waste product, involving a loss of oil, has been carefully recorded and the material sampled according to a recognised procedure the final figure for the total loss of oil, which is based on the results of the analysis, may be entirely inaccurate, however carefully the analysis itself may have been made.

It cannot be emphasised too strongly that the success of a system of factory control lies just as much in the accurate recording of the weights or volumes of the different materials and in the manner in which those materials are sampled, as in the analyses themselves. Errors in the factory cannot be rectified in the laboratory, they are more likely to be aggravated.

Provision must therefore be made for the installation of weighing machines at all stages of the process, where it is necessary to record weights of materials. Such machines should be preferably of an automatic type, provided the size of the factory is large enough to warrant such expenditure.

Similarly, in those cases where volume measurements are concerned, it will be necessary to arrange for the calibration of tanks and other containers, so that, for example, by measuring a difference in level of a liquid in a tank an accurate indication may be obtained of the volume of liquid involved in the particular operation.

If the volumes are too large to admit of records being compiled without incurring delay in the process, then automatic recording instruments should be installed.

As regards sampling, it is not possible to lay down definite rules owing to differences in factory procedure. Provided, however, the essential principles of sampling as indicated below are adhered to, the results of analyses of different series of samples will be comparable.

(i) The material is homogeneous.
(ii) Samples are drawn at regular intervals throughout the process.
(iii) A constant proportion is maintained between the sample and the amount of material sampled. If possible, the proportion should be not less than one half per cent.

For example, assuming the pericarp residue from the depericarper screen is collected in small trucks (capacity 400 lbs.), a definite amount, 2 lbs. should be taken at random from each truck load, as soon as the weight of the material has been recorded. These 2 lb. samples of pericarp residue may then be bulked, the material only being sampled for analysis at regular intervals as considered necessary.

Prior to sampling for analysis the weight of the material should be checked in order to ascertain the loss of weight, if any, during the period of collecting the individual samples, any loss being taken as due to evaporation of moisture. The necessary correction can be applied, and the gross weight of the sample calculated, assuming it to have been drawn at the time of the original weighing.

Similarly, if wash water is being run off from a tank, a definite amount of water, 100 c.c., is taken with every 2 inch or 3 inch fall of the level of the contents in the tank. The separate samples are bulked, and the requisite sample drawn for analysis.

These two examples have been given in order to show the possibility of reducing the number of samples for analysis by relying upon a systematic method in drawing them. Thus, in the case of the pericarp residue it might only be necessary to analyse a sample after 3 or 4 hours working or, in the case of the wash water, when a certain set of tanks had been emptied.

The variable nature of the products to be analysed necessitates a well-equipped laboratory and above all, an adequate staff. The question of the necessary laboratory equipment will be discussed later.

As regards the staff the number will depend on the size of the plant, and the extent to which factory control is to be carried out.

Since, however, practically all the analyses are of a routine nature, it is considered that an Asiatic staff would be capable of carrying out the analytical work required.

The extent of the European supervision will depend upon the size of the factory. While in the case of estates of 5,000 acres or less the factory engineer might possibly combine the work of supervising the Asiatic staff with his other duties, for larger estates the full time services of a supervising chemist would certainly be required.

The Asiatic staff should also be trained in recording accurately the weights and volumes of materials involved and in the sampling of the various waste products for analysis. These last two points are stressed once again, since experience in the interpretation of the results of analysis of oil palm materials has shown the writer that their importance, compared with the actual analytical work, is apt to be overlooked.

Measurements of Weight and Volume.

As indicated previously, a system of factory control necessitates the recording of a considerable number of weights and volumes of the different products at various stages of the process.

In the present section therefore it is proposed to give a list of the various records required in connection with the subsequent calculations regarding either the percentage recoveries of products or the losses of products at different stages of the process.

Assuming that (a) the factory process commences with the sterilisation of the fruit bunches, (b) there is no secondary treatment of the pericarp residue (c) palm oil and palm kernels are the finished products, the list is as follows:

1. Weight of fruit bunches.
2. Volume of condensed water from sterilisers.
3. Weight of bunch residue.
4. Weight of threshing machine waste.
5. Weight of sterilised fruit.
6. Weight of pericarp residue.
7. Weight of clean nuts from screen.
8. Volume of waste water from oil-washing tanks.
9. Volume of waste water from sludge recovery plant.
10. Weight of palm oil.
11. Weight of palm kernels.

1. *Fruit bunches.* As is well-known, in any large factory, the trucks containing the fruit bunches pass over a weighbridge on entering the factory, the weight of the bunches in any particular truck being obtained by deducting the tare weight of the truck from the gross weight as recorded on the weighbridge. The trucks are all numbered, and a list of the tare weights is kept for reference.

2. *Condensed water from sterilisers.* The principal object in measuring the amount of condensed water is to have a check both on the consumption of steam and on the loss in weight of the fruit bunches due to evaporation of moisture in the process of sterilising under pressure. The condensate is usually collected in tanks, two being placed side by side, so that when one is being filled the other may be emptied. As explained previously, the tanks should be calibrated, so that an accurate indication of the volume involved can be obtained by measuring the height of the liquid in the particular tank.

Any oil collecting on the surface of the water should be skimmed off and added to the crude oil in the factory.

3. *Bunch residue.* The fruit bunches after threshing are collected in trucks, which can leave the factory over the same weighbridge as that on which the fruit bunches were weighed. Owing to the possibility of loss in weight due to evaporation of moisture the residual fruit bunches should be weighed as soon as possible after threshing.

4. *Threshing-machine waste.* The weight of the waste material from the threshing machine must be recorded. This is usually carried out by arranging for the discharge of the material from the stripper into trucks, which can be run in below the threshing machine. The trucks, which could pass over the same weighbridge as that used for recording the weight of the sterilised fruit, would be tared similarly to those used for the fruit bunches.

5. *Sterilised fruit.* Although the recovery of products is usually based on the original weight of fresh bunches it is also important from the point of

view of control of process to have an additional check on the amounts of products compared with that of the sterilised fruit, since the latter really represents the raw material, as far as the actual process of recovery of products is concerned.

If the weight of fruit bunches is taken as a basis, greater variations are likely to occur in the calculated figure for the percentage of oil recovered owing to variations in the amount of fruit in the bunch, especially if a proportion of the bunches are from young palms. Further, the question of the incomplete threshing of bunches must not be overlooked.

In large factories it would be advisable to arrange for the installation of an automatic weighing machine to record the weight of fruit; in smaller factories, which cannot afford expenditure on such apparatus, arrangements should be made for the installation of a small weighbridge over which trucks containing the sterilised fruit would pass.

6. *Pericarp residue.* This material would be weighed as it left the depericarper screen. For this purpose a weighbridge should be installed near the end of the screen, so that trucks filled with the residue can be weighed, before the latter is used as fuel for the boilers.

7. *Clean nuts from screen.* The clean nuts leaving the depericarper are collected in trucks, which could pass over the same weighbridge as that used for recording the weights of the trucks containing the pericarp residue.

8. *Waste water from oil-washing tanks.* The volume of the water from the oil-washing tanks run to waste must be measured. Provided the tanks have been calibrated previously, the volume can be determined with sufficient accuracy by noting the difference in level in the tank before and after running off the water, and multiplying by the necessary factor to convert to gallons.

9. *Waste water from sludge recovery plant.* Similar measurements of the volume of the water run to waste from the sludge recovery plant must be taken.

10. *Palm oil.* The weight of purified oil must also be recorded. If the oil is being shipped in barrels or drums this is a simple operation, but if, as is more likely, the oil is being shipped in bulk a different procedure must be adopted. In this case the oil is pumped into tanks, in which the volume can be measured, the weight of oil in lbs. being calculated by multiplying the volume of oil in gallons by 0.9. Although the latter figure is only an approximation, the method of calculation is considered sufficiently accurate for the purpose of factory control.

An automatic machine for weighing the oil on passing to the bulking tank could be installed; such a refinement, although resulting in much greater accuracy, is, however, considered scarcely necessary.

11. *Palm kernels.* The kernels are packed in bags, which are weighed on leaving the factory, prior to being stored for shipment.

Sampling.

In the present section it is proposed to refer briefly to certain points connected with the sampling of the various products for analysis.

While, as explained previously, it is not possible to lay down a definite procedure applicable to all factories, representative sampling can always be ensured, provided the method adopted is based on the principles already laid down.

In order to preserve uniformity it is proposed to refer to all the products previously enumerated, even though in some instances no sampling is required.

1. *Fruit bunches.* No sampling of bunches is carried out.

2. *Condensed water from sterilisers.* Sampling of the condensed water may be carried out, either by means of a drip tap fitted into the pipe leading from the tank or by taking a sample of the water from the end of the pipe at regular intervals throughout the discharge. In the case of the drip tap, care must be taken to ensure that the tap does not become choked.

3. *Bunch residue.* While regular sampling for analysis is unnecessary on account of the low oil content of the material, it is considered advisable at definite intervals, for example once a week, to check the percentage of sterilised fruits in the bunch residue and to take a sample of the cleaned residue for analysis.

A truck load of threshed fruit bunches is selected at random and passed through the threshing machine in order to ensure complete separation of fruit. The sterilised fruit is cleaned from adhering bracts and stalks, weighed, and the proportion in the bunch residue calculated.

Ten pounds of the cleaned residue, obtained by chopping small pieces from individual bunches, are weighed, dried in the sun and the loss in weight recorded. The dried material is chopped still more finely prior to being sampled for analysis.

4. *Threshing machine waste.* A sample of material is drawn from each truck and the weights of the individual samples recorded. When sufficient waste has accumulated, the bulk sample is weighed again and the loss, due to evaporation of moisture between weighing and sampling, is calculated.

5. *Sterilised fruit.* Sampling of sterilised fruit is only necessary in that system of control in which the calculated results of the factory process are compared with those obtained by carrying out the same process on a small scale.

In the latter case, for example, all the individual samples of fruit collected during the working day are bulked and treated as a separate charge in the press or centrifugal extractor, similar records being compiled and similar analyses carried out for the waste products from this charge as for the whole of the fruit treated in the factory during the same period.

While the alternative method provides a check on the original results, the adoption of such a procedure must increase considerably the work of the laboratory staff and it is not therefore proposed to recommend its adoption at present in oil palm factory practice in Malaya.

6. *Pericarp residue.* Samples of the pericarp residue are drawn from the trucks after having passed over the weighbridge. The weight of the bulk sample should be checked before sampling for analysis in order to account for loss in weight due to evaporation of moisture.

7. *Clean nuts from screen.* A similar procedure to that recommended for the pericarp residue should be adopted in the case of this material.

8. *Waste water from oil-washing tanks.* Sampling of the waste water from the washing tanks is carried out either by means of a drip tap fitted to the pipe leading from the tank or by taking a sample of water from the end of the pipe at regular intervals throughout the discharge. Owing to the presence of a certain amount of solid matter in the water care must be taken to ensure the proper working of the drip tap.

9. *Waste water from sludge recovery plant.* A similar procedure to that recommended for the waste-water from the oil-washing tanks should be adopted.

10. *Palm oil.* Samples of oil may be taken by means of a drip-tap fitted to the pipe leading to the storage tank.

11. *Palm kernels.* A small handful, 20 kernels, is taken from each bag and bulked for the purpose of drawing an average sample.

Selection of Samples for Analysis.

Before describing the methods of analysis for the various products it is considered advisable to draw attention to the necessity of ensuring thorough mixing of the bulk sample before drawing one for analysis.

While this is simple for the liquid materials, since the bottle or other closed container can be well shaken, thereby ensuring homogeneity of contents, special precautions must be taken in the case of the solids.

As is well-known, the usual method of drawing a sample for analysis from solid materials, such as those under discussion, is to mix the individual samples into a heap, which is gradually reduced in size by the method of quartering. This process is continued, until only a small quantity of the original material remains, when the sample for analysis can be drawn.

In order to ensure satisfactory results with the method of quartering it is essential that the material should be of an even size. If therefore, for example, the threshing machine waste bulk sample should contain a proportion of bunch stalk, the latter should be picked out, cut into small pieces and re-mixed with the remainder of the material before quartering commences.

Methods of Analysis.

Apart from the analyses of the ultimate products, palm oil and palm kernels, to which reference will be made later, the analytical determinations in the case of the waste products are comparatively simple. Only two estimations are comprised, moisture and oil, while in some instances it is unnecessary to determine even moisture, provided the material is dried sufficiently to permit of the oil being completely extracted on treating with a solvent.

The simplest method for the determination of moisture is by drying the material to constant weight in a steam oven at 100°C. Since there is an ample supply of steam in the factory, there would be no difficulty as regards a supply for the laboratory.

The most satisfactory method for the estimation of oil is by treating the dried material with a solvent in an extractor, for example, Soxhlet type, filtering the solvent extract, evaporating off the solvent and drying the residual oil to constant weight in the steam oven.

As regards a suitable solvent it is suggested that petroleum ether having a boiling point range 60°—80°C. could be used. Although such a solvent is not free from fire-risk, the danger is small, since the extraction flasks may be heated on a steam bath and similarly, when the solvent is being evaporated, the same procedure may be adopted. Further, the difference of 20°C., between the boiling point of the highest fraction in the solvent and the temperature of the steam oven, would ensure the comparative rapid drying of the residual oil.

When estimating the amount of oil in liquid waste products, for example, waste water from the washing tanks, the measured volume of liquid is first evaporated to dryness. The solid residue is treated in a Soxhlet extractor with solvent to remove the oil, which is dried and weighed. The oil content of the original liquid is then calculated.

Having now described briefly the general analytical methods it is proposed to refer to certain points connected with the various products previously enumerated.

1. *Fruit bunches.* No analysis is required.

2. *Condensed water from sterilisers.* A measured volume of the water, 200 c.c., is evaporated to dryness on the steam bath, the residue transferred to a Soxhlet extractor for treatment with petroleum ether. Owing to the somewhat sticky nature of the residue the latter should be ground with a small proportion of ignited sand in order to ensure satisfactory penetration of the solvent.

3. *Bunch residue.* The sample of cleaned bunch residue, 100 grammes, would be further dried in the steam oven and then extracted as described. After extracting for 2 hours it is advisable to grind the material with a small proportion of sand, to replace in the extractor and to continue the process for a further 4 hours, in order to ensure complete removal of the oil.

4. *Threshing machine waste.* The sample of threshing machine waste, 25 or 50 grammes, would be dried to constant weight in the steam oven and solvent extracted as described in the previous paragraph.

5. *Sterilised fruit.* No analysis is required.

6. *Pericarp residue.* The sample of pericarp residue, 25 grammes, would be dried to constant weight in the steam oven and solvent extracted as described in paragraph 3.

7. *Clean nuts from screen.* A weighed amount of nuts, between 80 and 100 grammes, is taken and dried in the steam oven for a few hours. The nuts are solvent extracted in order to remove the palm oil on the surface.

8. *Waste water from oil-washing tanks.* A similar procedure to that described for the condensed water from the sterilisers is adopted with the exception that, owing to the higher oil content of the liquid, a smaller volume, 50 c.c., may be taken for the estimation.

9. *Waste water from sludge recovery plant.* A similar procedure to that described for the waste water from the oil washing tanks is adopted.

10. *Palm oil.* Three determinations are necessary in the analysis of palm oil (*a*) Moisture (*b*) Dirt (*c*) Acidity.

(*a*) *Moisture.* The moisture content of the oil is determined by drying a weighed quantity of oil, 10 grammes, in an oven for 4 hours at a temperature of 105°C. The loss in weight on drying is calculated as moisture.

(*b*) *Dirt.* The dirt content of the oil is determined by diluting 50 grammes of the oil with petroleum ether (B.P. 60°—80°C.) and filtering off the insoluble matter, which is washed free from oil with more petroleum ether, dried and weighed. The dry residue is calculated as dirt.

(*c*) *Acidity.* The acidity of the oil may be determined by one of two methods, which may be referred to as the hot method and cold method respectively.

(*i*) *Hot method.* A weighed amount of the oil, 5 grammes, is treated with 50 c.c. of neutralised alcohol. The contents of the flask are brought to the boil and, while still hot, are titrated against decinormal caustic potash solution, using phenol phthalein as indicator. The number of c.c. of alkali solution required to produce a pale pink coloration, persisting for 5 seconds, is taken as the volume of alkali required to neutralise the free fatty acids present in the oil.

The acidity of the oil is calculated as palmitic acid, 1 c.c. of decinormal caustic potash solution being equivalent to .0256 grammes of palmitic acid.

(*ii*) *Cold method.* A weighed amount of oil, 5 grammes, is diluted with 25 c.c. of petroleum ether (B.P. 60—80°C.) and 50 c.c. of neutralised alcohol added. A few drops of phenol phthalein indicator are added and the liquid titrated with decinormal caustic potash solution until a permanent pale pink coloration persists in the alcohol layer.

The calculation of the acidity of the oil is carried out similarly to that used in the hot method.

11. *Palm kernels.* Although it is not customary to analyse palm kernels, since they are invariably analysed on arrival in Europe, it may be of interest to record the required details of analysis. These would comprise determinations of the following constituents (*a*) Shell and Dirt (*b*) Moisture (*c*) Oil.

(*a*) *Shell and Dirt.* A weighed amount of the sample, 500 grammes, is picked over to remove any fragments of shell and dirt. These are weighed and the proportion calculated.

(*b*) *Moisture.* Kernels are selected at random and, after being cut in half, thin transverse slices are cut from individual half-kernels. Care must be taken to keep the slices even. A weighed amount of the slices, 10 grammes, is dried in the steam oven to constant weight, the loss in weight representing moisture.

The figure for the moisture content is important from the point of view of the estate owing to the necessity of ensuring that the kernels have been dried sufficiently before packing and will not therefore deteriorate in transit.

(*c*) *Oil.* The dried material is treated with petroleum ether (B.P. 60°—80°C.) in a Soxhlet extractor. After 2 hours extraction the partially extracted slices are dried in the steam oven to remove petroleum ether, ground in a mortar with a small quantity of ignited sand and again extracted for a further period of 4 hours. The solvent extract is filtered and, after distilling off the petroleum ether, the oil is dried to constant weight in the steam oven.

In calculating the percentage oil content of kernels no allowance is made for the shell and dirt, the oil content being calculated on the sample as received.

Consideration of Results.

As a result of the various operations described a statement is compiled, in which the results of the working of the factory process for the particular period are tabulated.

A suggested proforma is given in Appendix I.

Although at first sight the statement may appear complicated, an examination will show that the statement consists merely of a summation of the various data obtained as a result of studying the individual stages of the process.

A preliminary study of the individual stages is therefore the first essential in the development of an efficient factory process. This was shown in the investigation on the comparative efficiencies of the centrifugal and press processes carried out recently at the Government Experimental Plantation, Serdang, the results of which have already been published in this Journal (1) (2).

While therefore a single factory control statement is of comparatively little value, except in so far as it affords an indication of the efficiency of the process, a series of statements in which slight changes in detail of factory practice are correlated with losses of oil, will prove of the utmost value to the chemist or factory engineer in working out the optimum conditions for the whole process.

Having then ascertained the optimum conditions, the figures in successive control sheets should show only very slight variations, and the reason for any increase in the loss of oil at any particular stage of the process should be easily explained. This was also borne out by the results of the Serdang investigations referred to previously; for example the figures for the percentage efficiency of the centrifugal process in four successive weeks were found to be 88.1, 88.3, 89.0 and 88.4 per cent. respectively, an average of 88.5 per cent. for the whole period and a difference of less than 1 per cent. between the maximum and minimum figures.

While the order of the figures indicates a comparatively high efficiency for the process the importance of maintaining the maximum figure cannot be emphasised too strongly, especially for the large factory where large amounts of products are involved. This point will be referred to later.

Laboratory Equipment.

While it is not proposed to give a complete list of the chemical apparatus required for the laboratory, since the amount would depend both on the size of the factory and the extent to which control is to be carried out, the following list, comprising the majority of the more important items, may be of interest.

Apparatus.

1. Analytical balance, 200 grammes, sensitive to 1 milligramme.
2. Analytical weights from 100 grammes to 1 milligramme.
3. Rough balance (Beranger system) 1000 grammes, sensitive to 1 gramme.
4. Box of weights from 500 grammes to 1 gramme.
5. Laboratory scales, 10 kilogrammes, sensitive to 10 grammes.
6. Box of weights from 5 kilogrammes to 1 gramme.
7. Steam oven, with 3 compartments, each compartment approximately 8 ins. x 8 ins. x 8 ins. and fitted with a shelf.
8. Steam bath. The holes in the cover should be fitted with sets of rings.
9. Drying oven for electric heating for temperature not exceeding 120°C. Size of oven 12 ins. x 10 ins. x 10 ins. and to be fitted with a shelf.
10. Iron stands with clamps and rings of various sizes.
11. Evaporating basins, round bottomed, 6 ins. and 4 ins. diameter.
12. Soxhlet extractors, complete with flasks and condensers, capacity of extraction flasks 200 c.c. and 120 c.c. respectively.
13. Extraction thimbles.
14. Filter funnels, 2 ins., 4 ins. and 6 ins. diameter.
15. Filter paper to fit.
16. Filter stands.
17. Porcelain pestles and mortars 4 inch and 6 inch diameter.
18. Wide mouthed flat-bottomed flasks for weighing residual oil, capacity of flask 200 c.c.
19. Measuring cylinders, 250 c.c., 100 c.c., 50 c.c., 25 c.c.
20. Desiccators, 10 ins. diameter.
21. Evaporating basins, flat bottomed for drying oil, 3 ins. and 4 ins. diameter.
22. Glass beakers, 250 c.c. capacity.
24. Gooch crucibles, capacity 10 c.c. with holder and rubber ring to fit.
25. Pressure flask with length of rubber tubing.
26. Water pump.
27. Burette, 50 c.c.
28. Burette stand.
29. White porcelain tile.
30. Dropping bottle for phenol phthalein solution.
31. Distilling flasks, 500 c.c.
32. Glass condensers (Liebig type) 18 inch jacket.
33. Rubber tubing.
34. Pipettes 100 c.c., 50 c.c., 25 c.c., 5 c.c. glass rod, glass tubing, corks, cork borers, files, scissors, scalpels and other similar accessories.

Chemicals.

1. Petroleum ether (B.P. 60°—80°C.)
2. Alcohol (95 per cent.)
3. Phenol phthalein solution.
4. Decinormal caustic potash solution.
5. Decinormal sulphuric acid for standardising caustic potash solution.
6. Calcium chloride.

Apart therefore from the building itself, the fitting up of the laboratory necessitates a considerable capital outlay, while, on account of the large proportion of glassware among the apparatus, the liability to breakage must not be overlooked.

A rough estimate for apparatus and chemicals places the original cost, even for a small laboratory, at approximately $1,200.

As regards the laboratory, arrangements would have to be made for water, steam and electricity supplies. The provision of these services would not present any difficulty in view of the requirements of the factory in these directions.

Conclusions.

It will be realised from the foregoing account that even a simple system of factory control, such as that outlined, is only feasible for large oil palm factories, from which the output of products is sufficiently great to warrant the necessary expenditure.

It is obviously unreasonable to suggest the introduction of the system for an estate of 1000 acres or even 2000 acres. The only method by which estates of this size could engage in factory control would be by joining with other estates in the erection and equipping of a central laboratory; even then it is doubtful whether the expenditure would be justified, more particularly in view of the relatively small output of products.

In the case of small estates the present system, namely the correlation of bunch or fruit weight with that of oil, is probably sufficient, bearing in mind that the optimum conditions for each individual stage of the process have been worked out and published (1) (2). If, therefore, estates maintain these conditions it is reasonable to suppose that their yields of products, in addition to showing only very small variation, should also be approximately maximum figures. For example, at Serdang, using the centrifugal extraction process, the average weekly oil recovery for the first four months of the present year was 26.4 per cent., the maximum figure being 26.8 per cent. and the minimum 26.0 per cent. These figures are based on the weight of the fruit as delivered to the factory, the fruit containing approximately 10 per cent. of trash.

Large estates, for example 5,000 acres or more, in which the annual output of products is much greater are in a different category. For an estate of 10,000 acres in full bearing, calculations show that, allowing annual outputs of

16 cwt. of oil and 4 cwt. of kernel per acre and prices of £18 per ton for oil and £8 per ton for kernels, the annual value of the products is approximately $1,400,000. A variation of only one half per cent. in the output of palm oil alone is equivalent to a difference of over $6,000 per annum, an amount which might reasonably be expected to cover the greater part of the cost of the annual upkeep of the factory laboratory and for the expenditure of which the estate would also have the additional chance of ensuring the maximum revenue from its factory as a result of the introduction of an efficient system for the control of losses of products.

References.

(1) Georgi, C. D. V., The Centrifugal Extraction of Palm Oil at Serdang; *Malayan Agricultural Journal,* Vol. XX, No. 9, September 1932, page 446.

(2) Georgi, C. D. V., A Comparison of the Press and Centrifugal Methods for Treatment of Oil Palm Fruit. *Malayan Agricultural Journal,* Vol. XXI, No. 3, March 1933, page 103.

APPENDIX 1.

FACTORY CONTROL STATEMENT FOR.....ESTATE

DATE.....

1. *Record of Weights and Volumes of Products.*

	lbs.
Weight of fruit bunches	
Weight of bunch residue	
Weight of threshing machine waste	
Weight of sterilised fruit	
Weight of pericarp residue	
Weight of clean nuts from screen	
Weight of palm oil	
Weight of palm kernels	
	gallons
Volume of condensed water from sterilisers	
Volume of waste water from oil-washing tanks	
Volume of waste water from sludge recovery plant	

2. *Bunch Sterilisation Statement.*

	lbs.	lbs.
Weight of fruit bunches		
	lbs.	per cent.
Weight of bunch residue		
Weight of threshing machine waste		
Weight of sterilised fruit		
Loss in weight (by difference)		
		100.0

Note:—The approximate amount of steam consumed in sterilising the above weight of fruit bunches can be obtained by subtracting the loss in weight from the weight of condensed water from the sterilisers. The latter figure is obtained by multiplying the volume in gallons by ten, thereby converting to pounds of water.

3. *Bunch Residue Statement.*

	lbs.
Weight of bunch residue	a
Weight of sterilised fruit	b

$$\text{Proportion of sterilised fruit} = \frac{b \times 100}{a} \text{ per cent.}$$

4. *Results of Analysis.*

	Moisture per cent.	Oil per cent.	Oil (on dry basis) per cent.
Cleaned bunch residue		x	
Threshing machine waste	x	x	x
Pericarp residue	x	x	x
Clean nuts from screen		x	
		lbs. per gallon.	
Condensed water from sterilisers		x	
Waste water from oil washing tanks		x	
Waste water from sludge recovery plant		x	

Note:—An x indicates the extent of the analysis required.

5. *Losses of Palm Oil.*

	lbs.
Condensed water from sterilisers	
Cleaned bunch residue	These figures are
Sterilised fruit in bunch residue *	all calculated by
Threshing machine waste	multiplying the
Pericarp residue	weight or volume of
Clean nuts from screen	the product by its
Waste water from oil-washing tanks	oil content.
Waste water from sludge recovery plant	
Total	

* See Section 6.

6. *Final Distribution of Palm Oil and Efficiency of Process.*

Knowing the weight of the oil recovered from a given weight of fruit bunches or sterilised fruit the distribution of the oil at the different stages of the process can be calculated as percentages of the total weight of oil originally present. The latter figure is obtained by adding together the weight of oil recovered and the sum total of the various losses of oil cf. 5.

The figure for the amount of "Oil recovered" in the column headed "Percentage of Total Oil" is usually referred to as the "Percentage Efficiency", representing the proportion of oil recovered to the total amount of oil taken as 100 per cent.

The percentage oil content of the fruit bunches or of the sterilised fruit can be calculated by multiplying the weight of oil by 100 and dividing by the weight of material involved.

Stage of Process	Weight of Bunches lbs.		Weight of Sterilised Fruit lbs.	
	Distribution of Oil lbs.	Percentage of Total Oil	Distribution of Oil lbs.	Percentage of Total Oil
Condensed water from sterilisers (loss) ...				
Cleaned bunch residue (loss) ...				
Sterilised fruit in bunch residue (loss) ...				
Threshing machine waste (loss)				
Pericarp residue (loss) ...				
Clean nuts from screen (loss) ...				
Waste water from oil-washing tanks (loss) ...				
Waste water from sludge recovery plant (loss) ...				
Oil recovered ...				
Total Oil ...		100.0		100.0

Calculated oil content of fruit bunches = per cent.

Calculated oil content of sterilised fruit = per cent.

Note:—There will be no entries in the first four columns under the heading "Weight of Sterilised Fruit".

7. *Palm Kernel Recovery Statement.*

	lbs.
Weight of fruit bunches	
Weight of sterilised fruit	
Weight of palm kernels	
	per cent.
Recovery of palm kernels (calculated on fruit bunches)	
Recovery of palm kernels (calculated on sterilised fruit)	

8. *Analysis of Palm Oil.* per cent.

Moisture

Dirt

Acidity (calculated as palmitic acid)

9. *Analysis of Palm Kernels.* per cent.

Shell and Dirt

Moisture

Oil

GINGELLY

BY

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Introductory.

In view of the attention given at present to annual crops for Asiatic smallholders, it is thought opportune to give a short account of gingelly and its cultivation in Malaya. This crop has been cultivated with success from time to time on Government Experimental Plantations over a period of many years and information has been published on several occasions (1), (2), (3).

The greatest interest shown in this crop is by Southern Indians, since gingelly is cultivated extensively in Madras. In Malaya, gingelly oil is commonly used by the Indian population, whereas coconut oil is employed by Malays and groundnut oil by Chinese.

Description.

Gingelly, sesame or til, *Sesamum indicum*, is known to the Malays as 'bijan' or 'linga' and to the Tamils as 'ellu'. It is an annual erect herb growing to a height of from two feet to as much as six feet, according to the fertility of the soil in which it is grown.

The flowers are usually borne singly on short pedicels in the axils of the leaves; the corolla being white or pink in colour according to the variety and in shape not unlike the foxglove. The seed capsules are pubescent, green, turning brown when fully ripe and splitting at the apex to liberate the white or black seeds. The seeds are small, ovoid, and flattened, and there are in the neighbourhood of 200,000 seeds to the pound.

The two principal varieties of *Sesamum indicum* are white and black according to the colour of the seeds. There are, however, a number of other varieties with seeds ranging in colour from dark brown to almost red. The black seeded variety is a more robust plant than the white.

Gingelly is commonly cultivated in India and, to a smaller extent, in other parts of the tropics and sub-tropics, such as Japan, China, Abyssinia, East Africa, and Palestine. The crop is grown for its seeds which yield from 40 to 50 per cent. of a clear yellow or light brown oil which is extensively used by Indians for culinary purposes and anointing the body. Gingelly seeds are imported into Europe, mainly Marseilles, where the oil is extracted and used in salad oils as well as for other purposes.

Imports.

Large quantities of the seeds are imported into Malaya annually; the oil is expressed locally and used largely by Indians; the residual cake or "poonac" is used as a cattle food. Owing to the large reduction in the Tamil population on estates in Malaya, consumption has declined considerably recently. Imports of gingelly seed and oil into Malaya for the year 1932 obtained from official returns, are shown in the following table :—

Net imports of gingelly seed and oil into Malaya, 1932

Commodity.	Quantity.	Value.
Gingelly seed ...	2,708 tons.	$326,286
Gingelly oil ...	220 cwts.	$ 3,835

Re-exports were 152 tons seed and 338 cwts. oil, which are not included in the above figures.

Assuming that gingelly is grown as a rotation with other crops, and occupied the same land once during the year, approximately 10,000 acres would be required to replace the net imports into Malaya during 1932. This area is based on an average yield of 600 lbs. of cleaned seed per acre.

Import Duties.—The following duties on gingelly oil imported into the Federated Malay States have been imposed by the Federated Malay States Government, vide Gazette Notification No. 2440 of 31.3.1933 —

Edible Oils and Fats :

Gingelly oil, per pound, 4 cents full duty, 2 cents preferential duty.

Soils and Cultivation.

In India it is said that gingelly is grown on nearly all kinds of soil, ranging from the rather poor types to the rich delta lands. It is cultivated as an intermediate crop between padi seasons when the rainfall is favourable, and also mixed with such crops as cotton and sorghum (*Andropogon Sorghum*). In Malaya, it has been found that gingelly can be grown with success on both sandy and clay loams, as well as on heavy alluvial clay soils, providing they are well drained and a good surface tilth can be obtained. It does not grow well on poor soils that have been subject to erosion, and it has been found that, on acid soils, the crop is poor unless lime is applied. To obtain remunerative crops it is essential that the soil should be well supplied with humus and available plant foods.

The land should be well cultivated to a depth of five or six inches and the surface soil brought to a fine tilth. This may be accomplished with ploughs and harrows, or by manual labour, but, as the crop is one which has to be produced cheaply, the former methods are an advantage where the crop is grown on a large scale.

The seeds may be sown broadcast at the rate of four or five pounds per acre and harrowed in, or in drills eighteen inches apart. It is advisable to mix the seed with three or four times its bulk of dry sand or wood ashes, to facilitate even distribution, and to prevent the seeds being sown too thickly.

In Malaya, the best time for sowing is March or April and October or November, so that the crop is well supplied with moisture during the growing period, and the crop can be harvested in comparatively dry weather.

Fresh seeds germinate in a few days after sowing and, in about three weeks, the seedlings are large enough to be thinned. If the seeds are sown in drills, thinning, and also weeding, is more easily carried out than when they are sown broadcast. While thinning, weeds should be thoroughly eradicated when, unless weeds are particularly troublesome, no more attention will be required until the crop is ready to harvest. The plants commence to flower in four to five weeks after germination of the seed, and the crop is ready to harvest within a further two months.

Harvesting

Harvesting should be undertaken when the majority of the leaves have dropped and the first few seed capsules are seen to be bursting. At this time most of the capsules will be green, but it is inadvisable to leave the crop too long in the field otherwise there will be considerable loss of seed.

Harvesting is performed by cutting the plants, tying them in bundles, and transporting them to an open shed with a hard clean floor. Here they should be stacked in heaps with the tops of the plants pointing inwards. They may be left in small heaps for a few days while a certain amount of heat is generated, and the stems and seed capsules turn brown. If the temperature of the stack rises too high it is advisable to turn it once or twice. The crop should then be laid out on a clean floor in the sun to dry. The capsules will burst, and the seeds can be threshed out by beating with sticks. The stems and other trash are removed, and the seeds swept into heaps and winnowed. The clean seeds should be well dried before they are stored.

Should cement floors not be available for stacking and cleaning the crop, an excellent floor for the purpose can be made by levelling the soil, beating it hard, and smearing the surface with cattle droppings. When dry, the surface of this floor can be swept clean. It is essential to have a hard clean floor otherwise there will be difficulty in obtaining seeds and there will also be loss of crop.

Should the weather be dry during the time of harvest, the stack may be made in the open, and covered at night to prevent it becoming damp from dew. It is not often, however, that the weather can be relied upon to remain dry at the time required, and it is advisable to have a floor prepared under cover as well as in the open.

Yields.

The yields of gingelly seed vary with the soil and conditions under which the crop is grown.

Crops of gingelly have been grown on a number of occasions by the Department of Agriculture.

The results obtained are shown in tabular form below :—

Gingelly grown on Government Plantations.

Situation.	Soil.	Actual yield.	Calculated yield per acre.
(1) Castleton Estate, Teluk Anson. Intercrop with coconuts.	Heavy alluvial clay.	1,122 lbs. from 1.85 acres.	600 lbs.
(2) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	85 lbs. from 1/10 acre plot	850 lbs. (black-seeded variety).
(3) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	65 lbs. from 1/10 acre plot	650 lbs. (white-seeded variety).
(4) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with artificial fertilizer.	35 lbs. from 1/20 acre plot	700 lbs. (white-seeded variety).
(5) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	50 lbs. from 1/20 acre plot	1,000 lbs. (white-seeded variety).

The plots numbered 2 to 5 may be described as good average land that had not suffered from erosion.

At the Experimental Plantation, Serdang, a crop of gingelly has recently been harvested (February, 1933) from an area of five acres, where it is grown as an indicator crop in a Soil Reconditioning Experiment. This consisted of manuring and growing green manure crops which were incorporated in the land.

The soil is of the valley quartzite type of very low fertility, as it has been under cultivation since 1924, when the land was cleared of secondary jungle. It should be noted that, previous to the application of manure in 1931, practically nothing would grow on this soil.

By the use of liberal dressings of cattle manure, artificial fertilizers and lime, it was found possible to grow a heavy crop of *Centrosema pubescens* which was dug into the soil during the latter part of 1932. Crops of 800 to 900 lbs. of dry gingelly seed per acre were harvested from these plots whereas, on land with artificial fertilizers only and a small crop of Centrosema dug in, yields averaging only 100 lbs. seed per acre were obtained. This experiment demonstrates clearly that soil of good fertility is essential to secure satisfactory crops. Furthermore, it must be emphasized that, owing to the small monetary return from a crop of this nature, it is necessary to select fertile land, since additional expenditure as a result of manuring is uneconomic.

On virgin land opened from jungle, or land kept in condition by the employment of a good cover crop, yields of 600 lbs. of clean seed per acre may be expected.

With a yield of 4½ piculs of seed per acre selling at $6 per picul, the return is $27. It is obvious that this low return will not permit of any profit being made with paid labour, unless grown in rotation with a more remunerative crop. As a rotation crop grown by the small-holder himself, gingelly has possibilities, since there is a considerable local demand and the crop occupies the land for three months only.

Local Extraction of Oil.

Gingelly oil is extracted by Indians in the vicinity of the majority of the large towns in Malaya. The usual method of extraction is by a locally made wooden pestle and mortar, the oil being removed by pressure between the pestle and mortar produced by a slowly revolving, heavily weighted pole. A pair of bullocks are employed to propel the machine, known as a "cheku". The wooden mortar, which is made of local hard-wood, lasts 3 to 5 years. The opposite end of the hard-wood can be utilised when the original mortar is worn out. The pestle lasts for 2 to 3 months only.

The mortar is charged with 7 gantangs (1 gantang = 6 lbs.) of seed and the machine is kept rotating for about two hours, when the operation is complete. The average quantity of oil extracted is about 14 katties, together with a residue of 18 to 20 katties of oil cake or poonac. With good bullocks four charges are dealt with in a day. Two men undertake the work, one man in charge of the bullocks and the other attending to the collection of oil from the mortar. A small quantity of brown sugar is commonly added to each charge of seed.

Gingelly seed is imported from India after the dry season and at other times from Java and Siam. Present prices are (May, 1933)—seed $6 per picul; oil, $15 per picul; and poonac $4 per picul.

In Kuala Lumpur, recently, a mechanical plant of four oil extractors was examined. The machines, of European manufacture, were stated to have been imported from India. The design is based on the ordinary "cheku" previously described. The plant was driven by a 15 B.H.P. electric motor. This factory is capable of dealing with 10 piculs of seed per day yielding a return of 3½ piculs of oil and 6½ piculs of poonac.

Conclusions.

Considerable quantities of gingelly seed are imported annually into Malaya for the local extraction of oil and cake. Recent imports duties on the oil into the Federated Malay States favour the local oil expression industry.

Under average conditions gingelly grows well in this country, and since it matures in just over three months from sowing, it is a suitable rotation crop for the small-holder. Yields average four and a half piculs of dried seed per acre. The seed is readily extracted from the capsules by hand. There is a considerable demand for seed for the local extraction of oil and no difficulty is experienced in disposing of the crop produced.

References.

(1) Liming Experiments, *Agricultural Bulletin,* F.M.S., Vol. IV, 1916, page 378.

(2) Local Production of Gingelly as a Catch Crop, *Malayan Agricultural* Journal, Vol. X, 1922, page 94.

(3) Guide to the Government Experimental Plantation, Serdang, F.M.S., 1931, page 16.

Selected Article.

MARKET REQUIREMENTS.*

R. H. Horne.

In considering market requirements and attempting to give any guidance in meeting them, it has to be remembered that the Tea Trade is an old and conservative institution. Certain demands have been created during years of trading; a certain type of tea has been established in particular countries, or even districts and has remained in favour for years. It is, therefore, obvious that any attempt on the part of producers to force a particular type of tea on the Trade is likely to meet with failure. The manufacturer of tea has to cater for his market, in the same way as any other manufacturer.

The Tea Trade, however, is not selling to one particular community, nor filling one particular demand. Tea now goes to every quarter of the globe and it is therefore not surprising that there is a great variety of demands; what may be an excellent tea for one country or district may be unsuitable for another. There are, however, generally accepted universal standards for tea, which, with an occasional exception, rule the prices of tea.

These standards can be roughly classified into the desirable and undesirable qualities. The desirable qualities are good, black, well twisted leaf, tip, even grades, quality, colour, strength and flavour; all to be aimed for when obtainable. The undesirable qualities are naturally their antitheses; poor leaf, stalk, thin liquor, taints, etc.

Few teas can be expected to combine all the good qualities and where some of these factors cannot be expected it is advisable to concentrate on the remainder. Thus, on a low-elevation estate, where it is impossible to obtain quality and flavour, it is essential to aim for colour and strength, with good appearance; such aids to flavour as rapid and hard wither and light fermentation are best left alone.

For medium and high-elevation estates, excepting those above say 4,000 feet, the problem of whether to go for quality and flavour or strength and colour is a difficult one. Each estate must be ruled by local conditions and by the price it commands.

Where prices are consistently good in comparison with neighbouring estates, the teas are probably supplying a particular market demand, and to make an alteration would be a dangerous gamble. In cases such as these, it does not follow that an improvement in the tea from a general standard would result in improved prices, as it may mean the loss of an established market. It is an unfortunate fact that realized prices are not always strictly relative to the accepted ideas of merit.

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The problem therefore, which confronts the Superintendents and Agents of these estates is whether to aim for quality, or colour and strength, or a judicious combination of all. Superintendents may have been told that their teas lack quality and colour. This criticism is not of much assistance, as apart from correcting definite faults in manufacture, it may not be possible to increase both quality and colour in the particular type of leaf coming into the factory for manufacture. A more helpful report would be that the teas are poor in quality and colour, and that one or the other should be aimed for in a greater degree. The best way of deciding the point is to experiment with two contrasting forms of manufacture.

With medium and medium high grown estates, on the average, only three or four months of the year are favourable for the production of flavoury teas, and somewhere between 60 to 65 per cent. of the crop is produced during the non-flavour periods. Therefore, under normal market conditions, the safest course for these estates is to make useful coloury teas with as much quality and "sweetness" as possible. Raw greenness should be studiously avoided. Greenness in the infusions is not a fault, as long as it is not a dull greenness. Greenness in the liquors is an undesirable feature, unless it is accompanied by flavour or pungency, of which it is often an essential adjunct.

Whatever the elevation of an estate, good appearance is of some value, and in low and low-medium estates is of importance.

The preservation of tip is an art which has largely been lost sight of. Tip, particularly in teas from lower elevations, is a distinct asset. The usual receipt for the production of tip is light rolling for the early dhools, but probably as much tip is lost owing to hard sifting and faulty firing as is ever conserved by a light rolling programme.

Probably the greatest factor dividing market requirements is that of grading. However good the value and attractive the quality offered in say, pekoes, a blender using B.O.P.'s in his packets will not change his buying, and under opposite conditions the same applies to a buyer selling a leaf blend. Therefore an increase in the sale of broken blends without a corresponding increase in leaf blends creates a relative stronger market for broken grades. This varying demand can be catered for, but the tendency has been if anything, to make too many changes in endeavouring to meet these demands, resulting in a glut of a particular grade. Very often satisfactory prices for a particular grade have led to an increase in the percentage of that grade, with a consequent lowering of the standard. Quite recently this has been illustrated in the production of excessively large percentage of B.O.P.'s. As the market then had too many B.O.P.'s with a doubtful right to the title and as there was a consequent reduction in the quantity of the true grade B.O.P.'s, the latter were the grades to benefit most by the change.

The question of percentage of grades is chiefly an economic one. While considerable change can be made in grading by altered sifting and cutting, this method can only increase the percentage of a grade at the expense of the standard of that grade or of some other grade. Frequently, however, general improvement in grade percentage can be achieved in the rolling room.

Turning once more to the question of liquors, conditions in Ceylon are such that in favourable weather, medium-elevation estates produce better quality than the high-elevation estates can turn out during the monsoon months. In spite of this large seasonal variation in quality, the majority of estates maintain a constant system of manufacture throughout the year, and a Dimbula estate may be discovered aiming for quality and flavour during heavy monsoon weather and a Dolosbage place, during a cold and dry February, concentrating on colour and strength. Under such conditions the best is not being got out of the leaf.

While teas sell well all the year round, they are probably filling a special market demand, and no variation in manufacture is necessary or desirable. In other cases, however, where teas are selling strictly on their merits, judicious variation of manufacture to suit natural conditions is called for.

The alteration of manufacture, however, necessitates great care, and again market requirements are worthy of study. Good quality may be obtainable, but the question arises for a medium estate, is it worth losing colour for quality? This depends on both the amount of quality and the market demand. Unless some idea of the degree of quality can be conveyed to someone who is in touch with the market, the most desirable type of manufacture may be missed.

A fact that is not generally recognised in Ceylon is that the quality of the Indian and Java crop has a bearing on the demand for Ceylon tea. A good quality Indian season may mean a poorer demand for flavoury and pungent Dimbula and Uva teas. A thin and "rainy" crop from India will probably make for a good market for coloury Ceylon tea. These are points which chiefly affect estates selling in London, and advice should be sought in that centre.

To produce the best type of tea to suit requirements, and in consequence to realise the best prices, is only possible by the closest co-operation between the Superintendent and his Agent. The average stereotyped report is admittedly of little assistance in determining any necessary alterations in manufacture, but is not as a rule intended to indicate the necessity for such a change. If there appears to be a definite fault in manufacture, this would be commented on separately. If a change in manufacture is considered necessary, this is a matter of some moment and would be the subject of a special letter or comment. The next step would then be experimental manufacture.

While it is easy for the tasters to say where a tea is undesirable, it is difficult for him to say what is wanted, and at the same time to make reasonable allowance for what is unattainable. All teas, even the best, would be improved if they had more colour, quality, flavour and better appearance, provided the

increase of one did not diminish some other. Undoubtedly the best way is for the Superintendent to send samples of various different systems, accompanied by full details of conditions of manufacture. The latter is important, as without them, both the samples and the resulting report may be misleading.

One word regarding experiments and experimental samples. The experiment should be very carefully carried out and as a rule only one change should be undertaken at a time. The leaf used should not only be leaf taken into the factory at the same time, but should also be bulked before withering. Every step of the manufacture should be identical except the one alteration. Firing presents a difficulty in this connection, and if two dryers of the same make are not available, it is best to load the trays of a dryer alternately with standard and experimental manufacture, taking care to "tab" each load. Any Superintendent who has personally undertaken an experiment of this nature will realise how important personal supervision is even to the final stage of sealing and marking samples, particularly the latter. Tasting samples should be at least a quarter of a pound each.

The variation of manufacture to suit market requirements is undoubtedly frequently necessary, but should on no account be undertaken without definite information of the type required from a well-informed quarter and certainty that the required standard can be attained.

Miscellaneous Articles.

THE INTER-DEPARTMENTAL AGRICULTURAL CONFERENCE, 1933

The annual Inter-Departmental Agricultural Conference was held for the fourth year in succession in Kuala Lumpur from the 8th to 12th of August.

As compared with that held in the preceding year this Conference was on a smaller scale, comprising as it did only members of the Department of Agriculture and the Co-operative Societies Department, with attendance by officers of the Rubber Research Institute and the Veterinary Surgeon, Selangor, at special sessions on subjects which were of particular interest to them.

In a preliminary address in which he invited the Hon'ble Mr. T. S. Adams, British Resident, Selangor, to open the conference, Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. & F.M.S. pointed out the great utility of such Conferences, allowing as they do for the discussion of agricultural problems and the formation of plans for the furthering of the policy of the Department. He stated that at the present time the main points of the Departmental policy may be summarised as follows:—

a. The extension of areas under crops other than rubber;
b. The introduction of new crops;
c. The improvement of agricultural products and their manufacturing processes;
d. Protection against pests and diseases;
e. Improvement of marketing facilities for peasant produce coupled with the financing of peasant agriculture;
f. The necessity for a more progressive and better informed outlook on agricultural matters in the minds of the peasantry.

The Conference was formally opened by the Hon'ble Mr. T. S. Adams, who stressed the importance for agricultural field workers of the study and understanding of the psychology of the peasantry.

The sessions on the first, second, fourth and fifth days, which were concerned particularly with the field problems of agricultural crops, were under the Chairmanship of the Director of Agriculture.

Mr. R. Boyd, Director of Co-operation, took the chair on the third day and a portion of the succeeding day when co-operative marketing problems and the use of the Rural Lecture Caravan for propaganda were discussed.

A brief resumé is given below of some of the more important points under discussion at the Conference.

Padi.—1. Standardisation of methods for (*a*) preliminary selection from local varieties of strains of padi for critical comparative trials at Selection Stations, (*b*) lay-out of comparative tests of pure strains at Test Stations, (*c*) nomenclature of strains under trial and of pure strains selected for distribution. 2. Departmental experiments on padi manuring and cultivation.

3. Milling problems—(*a*) Need for facilities where surplus padi is available, (*b*) need for uniformity of grain wherever padi is produced for milling, (*c*) need for milling tests on pure strains before they are chosen for distribution.
4. Improvement of padi competitions at agricultural shows.
5. Methods of estimating the padi yields of the country.

Copra.—The improvement of small-holders' copra and difficulties connected therewith.

Tobacco.—Recent results of tobacco experiments and steps that may seem desirable to extend tobacco cultivation.

Fruit.—The raising and distribution of planting material.

Rubber.—The Mouldy Rot problem with special reference to control of the disease in small-holdings.

Poultry.—The poultry policy of the Department of Agriculture and its relation to the work of other Departments.

Marketing.—Marketing Groups and their evolution into Co-operative Marketing Societies.

Consideration of any special problems relating to the preparation and marketing of rubber, copra, eggs, arecanuts.

Agricultural Education.—Instructional courses for Malay Officers and others at the School of Agriculture, Serdang.

Miscellaneous.—The work of District Economic Boards; methods of keeping Agricultural Experiment Station records and Agricultural Registers.

Visits paid by the Conference.—One morning during the period of the Conference was devoted to a visit of inspection to the Government Experimental Plantation, Serdang, and one afternoon session was replaced by an expedition to the Klang Coconut Station, the particular object of interest being the improved type of kiln erected by the Agricultural Department and advocated as being specially suitable for use by small-holders.

(H. D. M.)

THE TENTH MALAYAN EXHIBITION.

The Tenth Malayan Exhibition organised by the Malayan Agri-Horticultural Association was held in Kuala Lumpur on August 5th to the 7th. The Show was undoubtedly a great success and in the matter of exhibits and lay-out showed a considerable improvement on the preceding year.

The official return for attendance was 20,527 as compared with 23,177 for 1932. The weather throughout the period was excellent.

The Opening Ceremony.

After a preliminary speech by Mr. F. W. Douglas, President of the Malayan Agri-Horticultural Association, the Exhibition was opened by the Honourable Mr. M. B. Shelley, Chief Secretary, Federated Malay States; the occasion was honoured by the presence of His Highness the Sultan of Selangor, the Raja Muda of Perak and the Raja Muda of Selangor.

The Honourable the Chief Secretary, in his opening speech, referred to the progress which had been made in the matter of broadening the agricultural basis of Malaya and to the noticeable increase in domestic rice production. He stressed the importance of the efforts being made by the Agricultural and Co-operative Departments to improve the quality of peasant produce, which too often tends to fall below the standard set for the best grades in the world's markets, and commented on the successful results already achieved in this direction with native copra. Referring to the subject of estate agriculture he mentioned the attention which is being given to the utilization of rubber latex stating that increased exports of this product are taking place.

He commented on the striking advances made in the oil palm industry and on the possibilities which are said to exist for the development of a local trade in refined and bleached palm oil, which may replace to a certain extent some of the oils and fats which are at present imported into the country.

With reference to the Malayan pineapple industry he stated that measures for the improvement of the industry, which is definitely threatened with serious competition from other countries, had recently received careful consideration from the Government. In 1932 the total value of tinned pineapple exports amounted to $7,914,567.

He remarked on the development of tea planting on Cameron Highlands and on the generally satisfactory reports made by London tea brokers upon the samples submitted to them. The valuation placed upon these samples indicate that there are grounds for supposing that the teas produced at Cameron Highlands are capable of competing with the average teas of Ceylon and India.

In conclusion the Chief Secretary pointed out that in efforts to broaden the basis of agriculture in a country, Agricultural Shows play an important part. A brief inspection of the exhibits in the Exhibition indicated that as far as variety and range of production was concerned Malaya already evinces a satisfactory degree of breadth, it was in the direction of quality that improvement was needed. He considered that the utility of such Shows in bringing about this improvement was unquestionable.

After the Chief Secretary had declared the Exhibition open Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. and F.M.S., proposed a vote of thanks which was seconded by Mr. J. Hands, M.C.H., Vice-President of the Malayan Agri-Horticultural Association.

Sections of the Exhibition.

The Agricultural Sections comprised the following :—

Fruit, Vegetables, Cereals, Oils and Fats, Fibres, Horticulture, Poultry and Pigs.

The Non-Agricultural Sections were :—

Village Industries, Malay Schools, Weaving and Needle Craft, Art, Photography and Trade.

The following Institutes and Government Departments staged special exhibits :—

Department of Agriculture, Rubber Research Institute, Drainage and Irrigation Department, Federated Malay State's Railways, Public Health and Infant Welfare Departments, Posts and Telegraphs, and the Co-operative Societies Department, which also gave displays of educational cinema films in conjunction with the Public Health Department.

Competitive Sections.

The fruit and vegetable sections contained some excellent exhibits, including a very effective display of vegetables grown at the Government Farm Fraser's Hill and at the School of Agriculture, Serdang.

In the section for collections of vegetables from School Gardens, competition was exceptionally keen and some excellent displays were staged, some of the best containing a great variety of well grown vegetables.

The Fraser's Hill Dairy Farm exhibit was awarded a silver medal.

The School of Agriculture exhibit consisted of 28 varieties of vegetables grown by the students and was awarded a special prize of a silver medal.

Village and School Industries.

These sections included exhibits of home-made articles of fibre, wood, cloth, metal, pottery, etc., and contained the following special stalls :—

Selangor : Village handicrafts organised by the Tungku Laksamana. This stall was awarded a first prize for general excellence in the Village Industry Section.

Brunei : Native silverware.

Port Dickson : Malay women weaving mats and baskets of mengkuang.

Kelantan : Sarongs and other Malay handicrafts; this stall was awarded the second prize for this section.

Sultan Idris Training College : Demonstrations of cotton printing, basketry, pottery, stencilling and batik work.

English Schools, Kuala Lumpur : Separate exhibits were staged of the work done by scholars of the Maxwell Road, Pasar Road and Batu Road Schools.

The Kuala Pilah English School exhibited two looms and gave demonstrations of weaving.

The exhibits throughout these sections showed, in the main, a high standard of workmanship and there was no falling off in quality or quantity as compared with preceding years.

Trade Section.

The large nmber and high standard of the stalls in this section may be taken as a very gratifying indication of an increasing appreciation of the value of an Exhibition of this kind from a commercial point of view.

Machinery, motor cars, petroleum products, rubber goods, tobacco, fertilisers, wireless apparatus, modern barrels, sun helmets, photographic apparatus, and general merchandise, were among the many articles which were attractively displayed.

(H. D. M.)

THE EXHIBITS OF THE DEPARTMENT OF AGRICULTURE, THE CO-OPERATIVE SOCIETIES DEPARTMENT AND THE RUBBER RESEARCH INSTITUTE AT THE TENTH MALAYAN EXHIBITION.

THE DEPARTMENT OF AGRICULTURE.

The exhibit staged this year consisted of ten separate stands, each one designed to provide information on a particular agricultural subject and to demonstrate progress made as the result of recent research and field activities.

One of the two main central stands was devoted to lowland tea, tobacco, bleached palm oil and a display to illustrate a new method of vegetative reproduction.

The lowland tea consisted of exhibits of all grades of tea made at the Government Experimental Plantations, Serdang, displayed both in loose form and in packets as sold in Malaya.

Tobacco was the Virginian type, flue cured leaves from both the Serdang Experimental Plantation and the Singapore Pineapple Station being exhibited as well as cut tobacco and cigarettes prepared from each. Cheroots prepared from the Serdang leaves were also displayed. The refined palm oil exhibit showed palm oil at varying stages of the refining process, (*a*) crude oil, (*b*) bleached oil, (*c*) bleached and neutralised oil. Two different methods had been used for bleaching the oil; in the first case hot-air treatment, in the second the same treatment but with the addition of a catalyst which enables the oil to be bleached at a lower temperature.

Propagation of Tea by the Etiolation Method

Cigarette Tobacco Produced in Malaya

The vegetative propagation exhibit was concerned with the etiolation method employed successfully at the East Malling Fruit Station in England and which promises to be equally efficient for a number of tropical crops. Plants of tea from the field were exhibited which had been collar pruned six months previously. Each specimen had produced a number of rooted shoots averaging, in the six months since pruning, about ten for each treated bush. Young plants, being the severed shoots, were exhibited in water, a method of staging which clearly displayed the satisfactory root system that had been induced to develop. On the other central stand were staged specimens of poor and well prepared copra, specimens of a type of kiln recommended by the Department and of a kiln which exhibited many of the faults in construction common to the majority of native kilns. Specimens of oil from well prepared and poor quality copra demonstrated the difference in quality of the oil obtained from the two products.

One of the side stands was devoted to dairying and demonstrated some of the activities of the Department at the Serdang Stock Farm and at Fraser's Hill. Models were staged showing dairying technique and photographs, illustrating the two pure breeds of Friesian and Montgomery and the different types resulting from crosses between them were displayed. A model of the modern byre used at both Serdang and Fraser's Hill was exhibited and charts of bacterial counts made by the Health Department illustrated the purity of the milk retailed from both places.

Recent results obtained from experiments in the manuring of Oil Palms, Pineapples, Padi and Fodder grasses were shown on separate stands. A section of the Oil Palm stand demonstrated the low fertilising value of the waste products from an oil palm factory and emphasised the consequent necessity of studying the cost of transport and distribution of such materials before including them in any manurial programme. Specimens of Guinea grass in pots illustrated the marked response of fodder grasses to the use of basic slag on heavy soil.

On another stand, samples of the grades of tea produced at Tanah Rata Experiment Station, Cameron Highlands, were displayed along with charts showing the comparison between valuations by brokers for this product and the average prices ruling at the same time for Indian, Ceylon, Java, Sumatra and Nyasaland Tea.

Another stand dealt with marketing and grading problems in relation to copra, pineapples and coffee. Samples of small-holders copra prepared on kilns erected on the lines advocated by the Department were contrasted with average samples. Tabulated statements illustrated the profit accruing to the small-holder as the result of preparing his own copra as compared with the return obtained from selling nuts to local copra makers and the extra profit obtained when the copra was prepared on the approved type of kiln.

In the pineapple section, specimens of tinned pineapples were staged for comparison with the ungraded product now exported. The coffee section

demonstrated recent progress that has been made in the production and grading of coffee beans by small-holders in Kuala Langat district of Selangor.

One stand was devoted to the School of Agriculture where photographs of the School and Hostel and its surrounding were exhibited. A film depicting the School and the life and work of the students was shown at regular intervals.

As usual, there was a stand at which publications of the Department were available for sale and distribution.

THE CO-OPERATIVE SOCIETIES DEPARTMENT.

This Department staged one interesting exhibit illustrating the work of the Co-operative Egg Marketing Society which operates under its auspices in Krian. The stall contained a demonstration of methods of grading and of testing eggs by means of "candling".

THE RUBBER RESEARCH INSTITUTE OF MALAYA.

Exhibits from the Rubber Research Institute were staged by the Chemical, Pathological and Soils Divisions.

Chemical Division.

The general object of the exhibits from the Chemical Division was to create interest in the uses of latex and to provide information to producers in regard to treatment of latex for export.

The main stand consisted of an octagonal pyramid one side of which was devoted to special samples of sheet, crepe, blanket and compo grades.

One section was devoted to specimens showing the preservation and concentration of latex illustrating particularly centrifugal treatment of latex in order to remove constituents which cause discoloration of the latex during storage. Concentration of latex by creaming agents was shown in a glass vessel, in which the separation was in progress.

Another section was devoted to various non-caoutchouc constituents of latex —e.g. quebrachitol, lipin, proteins and phosphates, which influence the character and qualities of latex and rubber prepared therefrom.

The method of preparation of quebrachitol was illustrated by means of a flow diagram and samples of the various intermediate partially purified products.

The largest section which attracted most attention, was devoted to manufactured rubber articles including principally a range of products manufactured direct from latex, many of which represented applications to new uses.

The most popular of such exhibits were the "Dunlopilloo" sponge rubber bus cushions and the "Lastex" round rubber thread and bathing costumes containing this thread. One set of the cushions was mounted on a wooden seat so that visitors could test the comfort of this new type of seating, already being adopted extensively in buses in Great Britain.

One other very recent application of rubber to new uses which was also exhibited was the new "Plioform" powder and two articles moulded from this

The Copra Exhibit

Bleached Palm Oil

product which should constitute a new competitor in the plastics field, if the price is favourable.

Several types of firelighters composed entirely of raw rubber or containing raw rubber mixed with other ingredients were also exhibited.

A footpath prepared from the rubber roadway product developed at the Institute was laid in the main Exhibition building.

Pathological Division.

In view of the prominence given earlier in the year to the problem of Leaf Mildew disease, caused by the fungus *Oidium Heveae*, graphs and charts were prepared to illustrate the occurrence and distribuiton of the disease during 1933.

A plan map was shown indicating the infected localities.

The three principal types of dusting machines imported and used in Malaya *viz*: the Bjorklund, the Holder Sulphia III and an English machine — the Dustejecta were exhibited, together with explanatory data relating to the operation of sulphur dusting for the treatment of the disease and details of cost and method of operating the various machines.

Photographs of the dusting machines in operation were exhibited showing the formation of a cloud of sulphur dust reaching to the top of trees over 100 feet in height.

Two types of hand dusting machines for use in rubber nurseries and market gardens were also shown.

Charts giving data in regard to cost of dusting were also prepared and exhibited.

Root Diseases. In order that the exhibit should reflect accurately the new points of view in relation to root diseases held by the Pathological Division of the Institute as a result of recent research work carried out at the Institute, a new method of presentation was adopted.

Formerly, before the close affinity of the two principal root diseases — *Fomes lignosus* and *Ganoderma pseudoferreum* was suspected, each disease was represented independently.

The system adopted in the present exhibit was arranged to focus attention on the similarities instead of the contrasts between the two diseases and to indicate

(1) that the two diseases, in relation to origin, development and propagation can be treated collectively,

(2) that the practical problems in the field are merely variants of a single general problem.

The method adopted to achieve this object were

(1) the building of the exhibit around the general history of the origin, development and propagation of both diseases,

(2) incorporating all the diseases in one exhibit, so as to display them "in parallel" instead of "in series",

(3) exclusion of abnormal specimens which would distract attention from the main thesis.

The exhibit consisted of a central placard on which the general story of root disease was dealt with in its theoretical and practical aspects together with a series of specimens illustrating the characters of (*a*) infected jungle timber (as a source of infection), (*b*) the rhizomorph system (as the vehicle of infection), (*c*) the wood of infected rubber trees, (*d*) fructifications and artificial cultures on sterilized wood blocks.

Each phase was illustrated by parallel exhibits of each disease or its causal organism.

Ustulina Zonata :—An exhibit of "Dry Root Rot" caused by the fungus *Ustulina Zonata* was staged separately in order to emphasize the difference of this root and collar rot disease from the two principal root diseases already described. The fact that this disease is a wound parasite and that infection is effected by wind borne spores was emphasized.

Lightning Damage :—Owing to the fact that numerous losses of rubber trees, which were formerly diagnosed as due to the "Die-back fungus", are now known to have been due to lightning strike, an exhibit of specimens, photographs and an annotated plan was staged showing the features of typical lightning damage on a young plantation.

Soils Division Exhibit.

A small but instructive exhibit relating to soil problems included a diagram illustrating the general principles underlying the nutrition of the rubber tree, with explanatory data showing the ill effects of soil erosion and the ameliorative effects of natural undergrowth and also specimens of the more typical natural undergrowths, together with an album of photographs showing desirable and undesirable growths.

A few typical soil monoliths, with analytical data attached, illustrated the principal features of hilly, peaty and coastal clay soils on which rubber is cultivated.

Reviews.

Storage of Rice.

BY

M. Kondo and T. Okamura,

"Berichte des Ohara Instituts fur Landwirtschafthicl Forschungen".

Vol. 5, Nos. 2—4, 1932—33.

The authors of this article have carried out experiments on the physical properties, germinating power, chemical composition and vitamin B content of milled rice stored for one, two, three and four years in straw bags in the granary of the Department of Agriculture and Forestry at Kuraschiki, Japan. They showed that during storage the volume—weight, weight of 1,000 grains, water absorbing capacity and swelling capacity decreased and insect infestation increased while grain colour and lustre deteriorated, leading to the conclusion that 2 years was the limit of safe storage of rice in straw bags placed within a well constructed granary.

(These results support those which were derived from a similar experiment conducted in Kuala Lumpur some years ago (*Malayan Agricultural Journal*, Vol. 18, No. 9, 1930) when rice was stored in guni sacks in an experimental grain store).

As regards the germinating power of the rice, the authors found that this deteriorated by 80 per cent. within 1½ years and was almost entirely lost after 2½ years' storage. They found that, provided insects were kept in check, no material changes occurred in the chemical composition of the rice over a period of 4 years. This result has also been confirmed locally. In feeding experiments with fowls it was found that the vitamin B content decreased proportionately with the lapse of time, the loss being 8, 18, 44 and 77 per cent. after 1, 2, 3 and 4 years of storage respectively, while the limit of safety was placed at 2 years storage.

Further the authors show that the rate of decrease in the vitamin B content varied in proportion to the moisture content of the rice; rice containing 12 per cent. moisture losing an inappreciable amount of its vitamin B content in 12 months. They maintain that if the amount of vitamin B content retained by rice having 12 per cent. moisture after 12 months storage is reckoned as 100 then the comparative amounts of vitamin B retained by rice of 14 per cent. and 16 per cent. moisture are respectively 99 and 92 per cent.

Air-dried rice, stored in small containers in Malaya for 4 years, has been found to be practically equal in all its qualities to new rice but the authors of these papers record that air-dried rice stored under airtight conditions for 26

and 28 years was found to have undergone very little change physically or chemically. The vitamin B content was found to be equal to that of rice stored under good ordinary conditions for 2—3 years and, while boiled rice had a slight odour and was not very sticky, yet its taste was fairly good and its culinary characters were quite satisfactory.

This note shows that hulled rice of good quality dried to under 12 per cent. moisture content and packed in airtight containers can be stored safely for approximately 30 years.

H. W. J.

Supply and Marketing of Soybeans and Soybean Products.

BY

STEWART, BURLISON, NORTON and WHALIN,

Bulletin 386,

University of Illinois Agricultural Experiment Station.

This publication contains a detailed history of the growth and development of the cultivation of and trade in soybeans in the United States since 1920 with particular reference to the State of Illinois,—the most important centre in this respect, and gives an account of the increasing importance of soybeans and products in many parts of the world.

The bulletin includes chapters on supply, with reference to competing oils and fats; on consumption; on agricultural practices and on costs of marketing and processing; on inspection and grading; on prices; and on international trade.

It refers to the extending uses of soybean oil, to the value of soybean meal and cake for cattle feeds, soybean flour for use in human foods, and to the cultivation of soybeans for silage or hay.

Reasons for the increase in acreage of soybeans in Illinois have been that farmers "desired to substitute some crop that will take the place of oats in the rotation and be more profitable than oats when grown other than for feed or as a nurse crop", and "the soybean is adaptable as a leguminous catch crop when red clover or another legume in the regular rotation fails to produce a satisfactory stand".

"While labour and power requirements for soybeans are much higher than those for oats or timothy grass, the larger gross returns have been sufficient to pay relatively better for the use of time, equipment, and land", and "soybeans have made possible a cash crop during the year in which they were planted and have

not required the enlargement of livestock enterprises". "Many tenant farmers who, because of lack of equipment or capital, are definitely limited in their livestock enterprises, have found this crop well fitted to the farm plan."

From 1921 to 1927, with low yields and an undeveloped local market, returns from soybeans were insufficient to cover computed costs, but "the development of higher yielding varieties and the improvement in cultural methods have been important factors in increasing both the acre-yields and gross returns" and from 1928 onwards good profits have been made.

Yields have varied considerably—from 10 to 24 bushels per acre—according to the district and from year to year, and, generally speaking, yields below 16 bushels of beans per acre have been unremunerative. The lowest yields are in the southern parts of the State where, however, soybeans are mostly grown for hay.

"A restraining factor influencing the expansion of soybean acreage is that labour requirements for soybeans grown for hay do not fit in well with those for the major crops of the corn belt region, and for soybeans grown as a cash crop these requirements conflict markedly with those of other crops, especially with corn, on many farms."

"Recognition of the adaptabilities and limitations of soybeans with reference to the needs of Illinois agriculture has resulted in giving them a different place in the farming operations in the Southern, Central and Northern parts of the State. The crop is used in the northern part of the State not only for hay but also to some extent, when interplanted with corn, for grazing and ensilage; in the Central division the beans are mainly gathered, and in the Southern areas of the State the crop is used for hay, with a recent trend toward gathering for commercial purposes".

The bulletin is incomplete, however, in that it does not give the reasons for the above adaptations nor does it refer to their relationships to the major crops of the State.

It is noteworthy that the State of Illinois, which is between latitudes 37 and 43 North, is in approximately the same latitudes as Southern Manchuria, Korea, and Japan, whence soybean originated and where they are chiefly grown.

(R. B. J.)

Abstract.

THE POULTRY INDUSTRY OF INDIA.

Compiled and abstracted from an article by Mr. R. L. Pandey, Secretary, United Provinces Poultry Association, Lucknow, published in The Madras Agricultural Journal, Vol. XXI, No. 5, May, 1933.

Part I.

India is supposed to be the original home of poultry and it is assumed that the genus *Gallus* originally migrated from this country to other parts of the world, although it is difficult at the present time to trace this migration through all its stages.

Present condition of the industry. The industry as at present conducted by the local peasantry does not flourish. There is no system of improved breeding, feeding, housing etc. Fowls inbreed as they please and are bred to supply eggs and table birds without any attention to size or quality. The birds have generally to feed themselves or are fed but scantily by the owners, all that they can expect from them in the majority of cases being a scattering of grain. Under these conditions the vitality of the birds has deteriorated considerably and they have become susceptible to many diseases. Often, whole flocks are wiped out by plague, cholera, ticks and various types of fever. Taking into consideration the circumstances under which it has to exist the indigenous fowl is a hardy bird and is capable of enduring very great hardship, but on account of the treatment it receives, the size and laying capacity have greatly deteriorated.

Species of Fowls found in India. The red jungle fowl is found in abundance in the jungles of Northern India, along with different kinds of pheasants, while the grey jungle fowl, *Gallus Sonnaratti,* is found in the Southern Indian jungles. Domestic fowls that are common in India at present can be put under the following heads :—

(1) Those that resemble the jungle fowl; they seldom exceed 3 to 3½ lb. in weight and are very poor egg producers.

(2) *Aseels,* the pure-bred game-fowl; this breed is becoming very rare and is found in the hands of only a few breeders.

- (*a*) *Ghages*—resembling Aseels are slow maturing good table birds, but very poor layers.
- (*b*) *Chittagongs*—so called after the name of that district of Bengal. This is a valuable breed both as regards laying and table qualities.
- (*c*) *Karaknath*—The eyes, skin and blood of this breed are all black. This breed is gradually becoming extinct.

(3) Modern Breeds :—

(*a*) In this class will be the modern breeds of Europe and America such as *Rhode Island Reds, Leghorns, Minorcas etc.*

(*b*) The crosses between (*a*) above and the country fowls. These are bigger in size and are better layers.

(*c*) In addition to the classes enumerated above there are a number of geese, ducks, turkeys, guinea fowls and various kinds of pheasants.

Among the modern breeds, White Leghorns, Black Minorcas, Rhode Island Reds and Orpingtons are very popular and seem to stand the climate well.

Unfortunately the Central Government has till now done nothing to encourage the industry of poultry farming but of late some of the Provincial Governments have been showing more interest in the matter.

Methods of Marketing. There is no organised system of marketing eggs and fowls; marketing is in the hands of professional dealers, who make house to house collections and transport the produce to market towns. The eggs are sold by number and not by weight.

The average weight of an egg is about 1½ oz. and that of a table-bird generally about 3 to 4 lb. The average production of the country hen is about 40 to 60 eggs, but larger eggs command a slightly higher price. Table birds command prices ranging from 8 to 10d. according to size and demand. The industry is carried on between the peasant-producer on the one hand and the consumer on the other through the agency of a middle man who makes the most profit out of the deal.

Obstacles of the Industry. There are many difficulties hindering rapid development of this valuable industry, such as religious scruples, ignorance and poverty of the peasant, and susceptibility of the poultry to disease.

Part II.

Poultry Breeding in the United Provinces.

For the past 22 years some small effort has been made to effect improvement in Indian poultry. In 1910 an unofficial body was formed styling themselves The Indian Poultry Club. This body has been instrumental in interesting the public in modern pure-bred poultry by holding exhibitions in different parts of the country. The club also publishes a monthly journal "The Indian Poultry Gazette".

As an outcome of this club Sir Hercourt Butler, the late Governor of these Provinces asked his Government in 1919 to finance a small scheme, which would have as its objects : (1) The improvement of poultry in the United Provinces. (2) To popularise the breeding of fowls and (3) to educate the public on the importance of the industry.

Keeping these points in view, two farms were established in 1920—21, one in the Horticultural Gardens Lucknow, and the other at the Government Bovine Depot at Patwa Dangar, near Naini Tal. The object of these farms was :— (1) To demonstrate how poultry farming should be conducted. (2) To foster the breeding of such fowls as would be suitable to the conditions of the country. (3) To provide stock birds and eggs of the improved breeds for distribution throughout the whole Province. (4) To study the suitability and value of poultry foods grown in the country. (5) To study poultry disease as far as possible, and (6) to evolve a breed of fowl which would combine greater production with immunity from disease.

As regards the popularisation of good breeds of poultry and educational work, the following methods were adopted :—(1) Instructive and interesting articles were contributed to important newspapers on the importance of the industry. (2) Lectures were delivered, illustrated by lantern slides and later on by screening a film, on the poultry industry in India, (3) Poultry shows and demonstrations were organised at all important agricultural fairs and exhibitions which take place yearly in the Provinces, and in which the successful exhibitors were, as an encouragement, given prizes of stock birds or cash. (4) Pamphlets and bulletins were issued on poultry keeping free of cost. (5) Training was given to students in poultry keeping on up-to-date and scientific lines. (6) Local Association and Poultry Societies were organised in conjunction with the Co-operative Department. (7) Practical demonstrations were given by running a Railway Poultry Car, or Miniature Farm on wheels, which was fully equipped with up-to-date appliances etc. and which travelled all over the Province. (8) Recently, a monthly Poultry Journal in Urdu was started in which instructive articles are published on various subjects such as diseases, housing, feeding etc. (9) People interested in poultry were enlisted as members from all over the Province. (10) Mutual business transactions were arranged between farmers. In addition to this, thousands of advisory letters were issued and continue to be issued daily.

Success Achieved. Before this Association started, there were few people who understood the importance of the industry. To-day we find that most of the Provincial Governments and Indian States have started poultry breeding operations, and others are contemplating doing so under the ægis of the development Departments.

The Kashmir Government started four farms last year, these farms are being managed by late students of the association and everything is being done on well established lines.

The Government of the Punjab which started work under the direction of the Association some five years ago, have started four more breeding centres each under a Deputy Director of Agriculture.

Two men have been trained for the Government of Baroda State and are now engaged in the poultry work of that State.

Egg production of pedigree stock has been determined and it has been found that their production is more than 3 times that of the country fowl. The crossing of pure-bred poultry with the indigenous stock has resulted in producing a bird much bigger in size and with better laying capacity both in regard to quantity and quality than the country fowl. A brown Leghorn-desi cross pullet was put in the Egg-laying Test conducted by the Association, and laid 61 eggs in 64 days. The control of poultry diseases by sanitary measures has been studied. For example in 1928—29, the best year of the farm, the disease known as "Ranikhet Disease" broke out in India. The poultry stock was decimated and quite a number of farmers were ruined. Numbers of crows which are carriers of the disease died on the farm daily. Fowls on the farm contracted the disease but prompt measures were taken and only 10 birds out of a flock of 1300 died and the carcasses of these where at once destroyed. The saliva of the infected birds was sent to Muktesar for examination and after being tested was found to contain the infective principle of "Ranikhet Disease". Local food stuffs were tested and their suitability as poultry food ascertained and poultry keepers advised accordingly. A suitable breed of fowls has been evolved. This breed combines increased egg production with size and quality, also greater immunity from disease. Some of the birds of this breed are now 5 years old and they still lay quite well, the size of eggs being remarkably good. Both in 1929—30 and 1930—31 the eggs from this breed won first prize in the large white egg class of the All India Poultry Exhibition.

Departmental.

FROM THE DISTRICTS.

The Weather.

On the western side of the Peninsula the weather was on the whole normal for the month, rainfall being somewhat heavier than in July. At Cameron Highlands, however, and in the lowlands adjoining the central portion of the main range rainfall was much above the average, while in Malacca, more especially the coastal area, there was a drought.

In the eastern States of Pahang and Kelantan conditions were unusually dry until the last third of the month when showers fell.

Remarks on Crops

Rubber. The highest and lowest prices in dollars and cents per pikul recorded during the month for small-holders' rubber were—Smoked Sheet $10 to $18.50; Unsmoked Sheet $8 to $17; Scrap $2 to $7. The average Singapore prices recorded for small-holders' rubber were—Smoked Sheet $15; Unsmoked Sheet $14 and Scrap $6, as compared with $17.50, $16 and $7 in July. The Penang prices for Unsmoked Sheet ranged from $13 to $15.50 against $12 to $18.40 in July.

Reports record a continued increase in the area tapped in spite of the slight fall in price, except in localities where padi planting operations or the fruit harvest were engaging the attention of small-holders. In some localities bark consumption was becoming heavier, mention being made of reversion to super-imposed cuts and to high tapping by means of ladders. In parts of Johore young rubber was being brought into tapping.

The rise in price has led to the slashing or clearing of weeds and undergrowth on a number of holdings.

Under wetter conditions mouldy rot disease has reappeared widely in previously infected districts, but has received more general treatment than in recnt months by the application either of approved disinfectants or of tar.

Padi. The price of padi at the Government Rice Mill showed a further slight rise to $1.80 per pikul. In Kedah also the price rose slightly, varying from $10 to $12 per kuncha (160 gantangs). These prices are equivalent respectively to 7¼ cents and 6¼ to 7½ cents a gantang.

Good progress was made with preparation of the land, sowing and planting throughout Kedah, Province Wellesley and Perak. In the Kuala Pilah District of Negri Sembilan planting has been slow, while in the coastal mukims of Malacca it was delayed by drought. In Kelantan the planting of dry padi was completed by the end of the month, but dry weather hindered the preparation of the land for wet padi and the nurseries were suffering from lack of rain. In the coastal districts of Selangor planting operations were commenced. The

planted crop in the inland districts of Selangor, the major portion of Negri Sembilan and in Pahang continued to make good progress, though in parts of the latter State the water supply was somewhat deficient.

Padi pests have not been particularly in evidence, though army worms did some damage to nurseries in Kedah and rats have caused damage to padi in all stages in Johore. Organised rat drives during clearing operations in Province Wellesley and Krian have proved successful as also have the usual methods of rat destruction in Malacca.

Coconuts and Copra. There has been further steady progress in the production by Malays of copra of improved quality. In Province Wellesley one more kiln has been completed and commenced work, while three more are in view. In Krian a large brick kiln of approved type is being built by a Malay who purchases nuts from European estates and contracts with the Irrigation Department for nuts from the palms growing along the canals and drains. In Temerloh District of Pahang the owners of the existing kiln have decided to allocate part of their profits to purchase materials for a brick kiln and two additional approved kilns should be in operation in the near future. The Malay Copra Instructor is touring the river mukims of Pekan District to encourage the installation of one or two kilns in this area. In Kelantan one approved kiln has been erected but is not yet operating.

Malays in Kuala Selangor and Sabak Bernam Districts of Selangor are showing renewed interest in group production because the better quality of the product made by the groups commands a higher price. The sale of copra direct to Penang from Sabak Bernam appears to be a success, since another group of four kilns has recently joined the existing two groups.

Fruit. The mid-year season for the more important fruits, such as durian, mangosteen, rambutan and pulasan was drawing to a close at the end of the month. On the whole crops were satisfactory. It is reported from Johore that good business was done in exports to the Singapore market. The report from Singapore states that large quantities of fruit were harvested in the island, it being estimated that in the middle of the month 16 tons of locally grown fruit were sold in the market daily. These large local supplies are an indication of the increased interest that is being taken in fruit production in Singapore.

Tobacco. Maintenance of the improved price has sustained interest in this crop. In Kedah 54 acres were planted while in Kuala Pilah District the planted area has been increased to 30 acres; new plantings are also reported from Selangor and Johore.

During the month 32 pikuls 26 katis of leaf were sold by growers in Singapore Island to factories in the town. Prices for cured leaf in Province Wellesley were $22 to $37; in Taiping $27 to $42; prices between $50 and $58 were paid for first grade leaf in Southern Perak, Ulu Selangor and Malacca town.

Agricultural Stations.

Preparation of the land for the further planting or supplying of plots of permanent crops has progressed well at Bukit Mertajam. Work on the revised lay-out of the Kuala Lipis Station has been commenced and some planting work has been done on the other three Stations in Pahang. On the Rembau Station maize, ragi, tapioca and various vegetables were harvested; further progress was made in the development of the Kuala Pilah Station. On the Pineapple Station, Singapore, the yield of fruits gradually decreased until only a few were harvested at the end of the month as the season is now over. Growth on all the blocks not yet in bearing was good. The remaining crop of tobacco was harvested and the types other than Virginian were cured with coconut toddy or by burying. Further nursery beds of Virginian varieties were sown.

Padi Stations and Test Plots.

Planting was nearing completion at the Telok Chengai Station in Kedah. At Titi Serong planting operations were in progress, as also at Pulau Gadong where the mechanical cultivation experiments were completed. At the Pasir Puteh Experiment Station in Kelantan the nurseries were sown. Preparation of the land was delayed by drought which necessitated pumping and ploughing on alternative days. Drought also caused difficulties at the Central Farm, Kota Bharu, where cultivation of the wet padi fields was only made possible by the use of the electric pump and of much labour to puddle the land sufficiently to make it hold water. At the Bukit Merah Test Plot the catch crop of tobacco was harvested, nurseries were sown and the land prepared for planting. Work on other Test Plots proceeded normally.

The Director of Agriculture visited Stations and Test Plots in Perak and Province Wellesley during the month.

Agricultural Course for Penghulus.

A course on copra manufacture for Penghulus was held at the Government Coconut Station, Klang, from the 19th to the 22nd August. Instruction was given by the Acting Agricultural Chemist and the Assistant Analyst. The acting Agricultural Field Officer, Selangor, also assisted. Sixteen Penghulus attended and had obtained a good knowledge of this subject at the end of the four days' course.

A short course on the cultivation and selection of padi was given to twenty five other Penghulus by the Agricultural Field Officer, Malacca, at the Pulau Gadong Station from the 19th to the 21st August. All those present showed a keen interest in this subject and many realised for the first time how selected padi strains are obtained and how much work is necessary to produce them.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., made an extensive tour of Perak and Province Wellesley, from August 17th. to 26th., visiting Experimental Plots, Agricultural Stations and agricultural undertakings in these territories. He also paid a short visit to Kedah to discuss with the Hon'ble the British Adviser, matters relating to agricultural services in that State.

The Director, accompanied by Mr. E. A. Curtler, Agricultural Field Officer, Cameron Highlands, attended the Conference held by the Incorporated Society of Planters at Taiping on August 19th. and delivered a paper, prepared by himself and Mr. Curtler, entitled "The Cultivation of Tea in the Highland Regions of Malaya".

The Acting Agricultural Chemist, Major C. D. V. Georgi, O.B.E., accompanied by Mr. Gunn Lay Teik, Assistant Analyst, visited Kampong Kuantan on August 23rd. on the occasion of the first shipment of palm oil in bulk by Selangor Bulk Oil Installation Ltd.

Mr. R. A. Altson, Assistant Mycologist, proceeded to Johore on August 23rd. in connection with a disease of oil palms, and returned to Kuala Lumpur on August 30th.

Inter-Departmental Agricultural Conference 1933.

The fourth Inter-Departmental Agricultural Conference was held at the Masonic Hall, Venning Road, Kuala Lumpur, from August 8th. to 12th., and was attended during all sessions, by members of the Field Branch of the Department of Agriculture and on certain days by members of the Co-operative Societies Department and the Rubber Research Institute of Malaya. A brief account of the Conference is published in the present issue of the Journal.

Visitors to Serdang and Klang

H.R.H. Prince Purachatra, who was on a visit to Malaya from Siam, visited the Government Experimental Plantation, Serdang on August 12th. and was conducted around the plantation by the Agriculturist, Mr. Bunting.

On August 22nd. members of the Klang District Rotary Club paid a visit to the Coconut Experimental Station, Klang, where Dr. H. W. Jack, M.B.E., and Mr. Gunn Lay Teik, explained the research work which is being carried out at the Station in connection with cultivation and selection of the coconut palm and demonstrated the working of a kiln suited to the requirements of small-holders. The kiln has been erected for the purpose of demonstrating, to small-holders and others, methods of improving the quality of copra manufactured in Malaya.

Statistical.

MARKET PRICES

August 1933.

Rubber.—The market price for rubber remained fairly steady during the month, opening at 12 1/16 cents per lb. for Spot loose in Singapore and closing at 12 cents. The average price for the month was 12 3/16 cents per lb. in Singapore, 3 13/16 pence in London and 7⅛ cents Gold in New York as compared with 12 11/16 cents, 3⅞ pence and 7⅞ cents Gold respectively in July.

Palm Oil.—The course of the English market during August on a basis of 18 per cent., f.f.a., c.i.f. Liverpool was as follows:—August 3rd £17.5.0 per ton, market easier, 17th August £16.10.0 per ton, market quiet, 24th August £16.15.0 per ton, market steady and August 31st £16.15.0 per ton, market quiet.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 3.60 cents Gold on the 4th August; 3.50 cents Gold on the 12th August; 3.30 cents Gold on the 19th; and 3.35 cents Gold on the 26th August.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was Shillings 8 per cwt. on the 4th August; Shillings 7/10½ per cwt. on the 12th; Shillings 7/9 per cwt. on the 19th; and Shillings 8 per cwt. on the 26th August.

Copra.—The market during the month has been a fairly steady one. The highest Singapore price for Sundried during August was $3.80 per picul, and the lowest price $3.60 per picul, the average price being $3.70 per picul as compared with $3.97 during July. The mixed quality averaged $3.13 per picul as compared with $3.37 in July.

Coffee.—During the month the price at Singapore for Sourabaya coffee was steady, the prices having fallen compared with July prices. Prices ranged according to grade, from $16 to $19 as compared with $20 to $22 during July. Palembang coffee averaged $13.12 during the month having dropped from $13.50 on the 4th to $12.50 on the 11th the average figure for July was $14.60.

Arecanuts.—Palembang's averaged $2.49 and Bila Whole $2.37 per picul as compared with $2.32 and $2.63 during July. The range of Singapore prices for other grades was:—Split $2.50 to $4; Red Whole $3 to $4.50, Sliced, $9 to $12, Kelantan $3 to $3.50.

Gambier.—Block Gambier again increased in price towards the end of the month, the average price being $4.75 per picul, Cube No. 1 averaged $8. Corresponding figures for July were:—$4.37 and $7.62 respectively.

Pineapples.—Values again firmed slightly during July, the average Singapore price per case being: Cubes $3.26, Sliced Flat $3.16, and Sliced Tall $3.25, as compared with $3.22, $3.15, and $3.39 respectively during July.

Tapioca.—The price of Flake Fair averaged $3.95 as compared with $4.20 in July. Pearl Seed averaged $5 as compared with $5.19 in July and Pearl Medium averaged $5 as compared with $5.31 in the previous month.

Sago.—Pearl—Small Fair as in July remained steady at $4.50, Flour-Sarawak Fair averaged $1.83 as compared with $1.91 in July.

Mace.—Prices ruling during the month were similar to July prices, namely $70 per picul for Siouw and $50 for Amboina.

Nutmegs.—There was a further drop in prices during August, Singapore price per picul for 110's was $20 as compared with $21.25 in July. 80's averaged $26.50 having averaged $29.12 in the previous month.

Pepper.—Average Singapore prices during August were as follows:—Singapore Black $13.19 per picul, Singapore White $23.12 and Muntok White $23.75, the corresponding figures for July were $14.69, $26 and $26.50 respectively.

Cloves.—As previously, the demand for cloves remains small, nominal prices being $40 for Zanzibar and $45 per picul for Amboina.

GENERAL RICE SUMMARY.

July, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during July 1933, amounted to 50,827 tons, as compared with 50,008 tons in June 1932 of which 54 per cent. were consigned to Singapore, 19 per cent. to Penang, 6 per cent. to Malacca, 14 per cent. to the Federated Malay States and 7 per cent. to the Unfederated Malay States.

Of these imports, 59 per cent. were from Siam, 38 per cent. from Burma, 2 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in July 1933 were 13,432 (including 203 tons local production) as compared with 13,924 tons in July 1932.

Of these exports 82 per cent. were consigned to Netherlands India and 18 per cent. to other countries.

Net imports for the period January to July 1933, were 238,066 tons as compared with 235,566 tons during the same period for 1932, a fall of 1 per cent.

India and Burma.—Total foreign exports of rice during June, 1933, were 221,000 tons as compared with 230,000 in the previous month and 182,000 tons in June 1932.

Siam.—Exports (approximate) during July 1933, amounted to 133,769 tons as compared with 101,286 in July 1932.

Netherlands India, Java and Madura.—For the period end of June 1933, the area harvested amounted to 6,825,000 acres, a decrease of 165,000 acres or 2 per cent. as compared with the corresponding period of 1932: the area damaged was 335,000 acres an increase of 64,000 or 24 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 2,102,000 acres an increase of 312,000 acres or 17 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January to July 1933, amounted to 77,585 metric tons an increase of 47,001 tons or 6 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to July 1933 totalled 865,047 tons an increase of 130,255 tons or 18 per cent. as compared with the corresponding period of 1932.

Europe and America.—Quantities of rice shipped from the East were:—

(*a*) To Europe for the period January 1st to July 27th, 839,064 tons, a rise of 209,729 tons or 33 per cent. as compared with the corresponding period of 1932.

Of these shipments 53 per cent. were from Burma, 3 per cent. from Japan, 37 per cent. from Saigon, 6 per cent. from Siam and 1 per

cent. from Bengal, as compared with 59 per cent. from Burma, nil per cent. from Japan, 34 per cent. from Saigon, 3 per cent. from Siam, and 4 per cent. from Bengal in 1932.

(*b*) To the Levant,—period January 1st to June 17th, 17,121 tons, a fall of 23,869 tons or 58 per cent. as compared with the same period of 1932.

(*c*) To America and the West Indies for the period January 1st to June 25th, 83,968 tons an increase of 13,554 tons or 19 per cent. as compared with the same period of 1932.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING JULY, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	1,447	3.2	8,113	18.1	9,560	21.4
Dindings	6,969	209	3.0	908	13.0	1,117	16.0
Malacca	111,780	5,315	4.8	19,376	17.3	24,691	22.1
Penang Island	1,635	776	47.5	55	3.4	831	50.8
Singapore Island	28,269	10,311	36.5	5,088	18.0	15,399	54.5
Total S.S. ...	193,387	18,058	9.3	33,540	17.3	51,598	26.7
FEDERATED MALAY STATES :—							
Perak	250,951	8,415	3.4	34,721	13.8	43,136	17.2
Selangor	308,379	10,672	3.5	44,753	14.5	55,425	18.0
Negri Sembilan	228,541	13,858	6.1	20,151	8.8	34,009	14.9
Pahang	38,141	6,957	18.2	5,374	14.1	12,331	32.3
Total F.M.S. ...	826,012	39,902	4.8	104,999	12.7	144,901	17.5
UNFEDERATED MALAY STATES :—							
Johore	325,747	31,859	9.8	37,836	11.6	69,695	21.4
Kedah (*a*)	114,551	5,254	4.6	8,984	7.8	14,238	12.4
Kelantan	21,175	6,925	32.7	2,461	11.6	9,386	44.3
Trengganu (*b*)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (*a*)	957	177	18.5	542	56.6	719	75.1
Total U.M.S. ...	466,782	44,215	9.5	51,895	11.1	96,110	20.6
TOTAL MALAYA ...	1,486,181	102,175	6.9	190,434	12.8	292,609	19.7

Notes :— (*a*) Registered companies only and are rendered quarterly.

(*b*) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in August 1933.

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN NETHERLANDS INDIA AS AT THE END OF THE MONTHS OF MARCH, APRIL AND MAY, 1933, RESPECTIVELY.

March	A Totally Ceased		B Partly Ceased		Total A & B	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
Java and Madura ...	136	54,226	67	17,021	203	71,247
Outer Provinces ...	204	70,316	72	40,664	276	110,980
Netherlands India ...	340	124,542	139	57,685	479	182,227
April						
Java and Madura ...	140	57,403	63	16,929	203	74,332
Outer Provinces ...	195	69,587	70	39,070	265	108,657
Netherlands India ...	335	126,990	133	55,999	468	182,989
May						
Java and Madura ...	131	50,090	60	16,791	191	67,700
Outer Provinces ...	197	69,372	70	38,623	267	107,995
Netherlands India ...	328	120,281	130	55,414	458	175,695

The total area out of tapping for March amounts to 18.7 per cent. of the total tappable area at end December 1932.
- do - - do - April - do - 18.8 - do - - do -
- do - - do - May - do - 17.9 - do - - do -

(For March, Authority: Economisch Weekblad, dated 26th May, 1933).
(For April, Authority: Economisch Weekblad, dated 23rd June, 1933).
(For May, Authority: Economisch Weekblad, dated 21st July, 1933).

MALAYAN AGRICULTURAL EXPORTS, JULY, 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan-July 1932	Jan-July 1933	July 1932	July 1933
Arecanuts ...	20,280	14,096	11,921	615	1,308
Coconuts, fresh † ...	108,123†	74,272†	59,536†	10,485†	10,742†
Coconut oil ...	11,932	6,097	10,507	910	1,064
Copra ...	97,464	42,716	46,626	5,662	7,531
Gambier, all kinds ...	2,925	1,773	1,361	271	144
Palm kernels ...	1,248	591	962	65	170
Palm oil ...	7,892	3,813	4,923	637	830
Pineapples canned ...	66,291	45,006	40,358	7,804	7,684
Rubber § ...	417,137	235,677	251,402	35,356	42,655
Sago,—flour ...	10,267	4,139	3,317	1,049*	1,383
„ —pearl ...	3,128	1,401	1,220	173	171
„ —raw ...	4,148*	2,432*	2,430*	352*	393*
Tapioca,—flake ...	9,028	5,276	6,669	755	661
„ —flour ...	392	259*	128*	96*	13
„ —pearl ...	19,977	11,902	9,511	1,455	1,536
Tuba root ...	165½	63	270½	13	39½

† hundred in number. § production. * net imports.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JULY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		January to July 1933		during the month		January to July 1933				
	Ports	Dealers	Estates of 100 acres and over	during the month	January to July 1933	during the month	January to July 1933	Foreign	From Malay States Labuan	Foreign	From Malay States Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States ...	...	12,758	11,632	11,894	76,570	11,065	59,712	Nil	Nil	Nil	Nil	16,156	7,406	95,778	44,591	...	12,103	11,669
Johore ...	...	2,924	3,177	3,598	24,616	5,117	30,037	Nil	3	Nil	23	1,894	6,989	8,583	46,159	...	2,999	2,937
Kedah ...	...	516	2,059	2,210	15,603	1,807	9,068	Nil	Nil	Nil	Nil	1,429	2,859	8,197	17,438	...	413	1,891
Perlis ...	...	15	10	5	52	19	66	Nil	Nil	Nil	Nil	Nil	24	Nil	138	...	14	11
Kelantan ...	...	266	165	221	1,139	1,108	3,673	255	Nil	330	Nil	94	1,240	516	4,226	...	501	180
Trengganu ...	...	55	50	185	857	92	427	Nil	Nil	Nil	Nil	Nil	277	Nil	1,284	..	55	50
Total Malay States	...	16,534	17,093	18,113	118,837	19,208	102,983	255	3	330	23	19,573	18,795	113,074	113,836	...	16,085	16,738
STRAITS SETTLEMENTS :-																		
Malacca ...	...	3,797	1,360	1,919	9,538			Nil		10		3,687		28,312		...	3,850	1,183
Province Wellesley	...	1,370	683	572	3,485			Nil		Nil						...	1,628	733
Dindings ...	...	29	107	107	663	2,577	14,846	Nil	18,884	Nil	114,275	7,215	Nil	43,587	Nil	...	31	124
Penang ...	1,748	4,417	7	6	19			971		4,142						1,147	4,948	8
Singapore ...	6,513	28,538	135	153	1,031			13,070		56,090		20,056		113,216		11,439	30,136	749
Total Straits Settlements	8,261	38,151	2,292	2,757	14,736	2,577	14,846	14,047	18,884	60,242	114,275	30,958	Nil	185,115	Nil	12,586	40,593	2,197
TOTAL MALAYA	8,261	54,685	19,385	20,870	133,573	21,785	117,829	14,302	18,887	60,572	114,298	50,531	18,795	298,189	113,836	12,586	56,678	18,935

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
20	21	22	23	24	25	26
DRY RUBBER	8,816	23,863	4,140	5,179	1,120	133
WET RUBBER	3,287	6,273	808	330	1,879	280
TOTAL ...	12,103	30,136	4,948	5,509	2,999	413

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to July inc. 1933
Singapore ...	32,029	178,695
Penang ...	12,021	69,726
Port Swettenham.	6,141	42,301
Malacca ...	340	7,467
MALAYA ...	50,531	298,189

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to June inc. 1933
Malay States ... / Straits Settlements	37,157	240,473
MALAYA ...	37,157	240,473

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + 15 tons local consumption during the month — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25 %; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5 The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24th August 1933.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1933.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	89.2	71.4	80.3	93	69	86	73	83.7	84.8	5.24	133.1	1.40	16	13	4	2		183.90	5.93	49
Bukit Jeram, Selangor ...	88.0	72.4	80.2	90	70	85	75	84.1	86.6	5.03	127.8	2.00	14	10	2			193.65	6.25	51
Sitiawan, Perak ...	89.7	72.6	81.1	93	70	83	76	84.6	86.1	4.56	115.8	2.85	12	10	1			176.50	5.69	46
Kroh, Perak* ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Temerloh, Pahang ...	88.9	72.3	80.6	92	70	84	75	84.8	86.2	3.46	87.9	1.28	14	10		1		173.50	5.60	45
Kuala Lipis, Pahang ...	87.5	71.5	79.5	91	67	83	74	84.0	85.0	11.20	284.5	2.40	16	15	3	25		162.65	5.24	42
Kuala Pahang, Pahang ...	86.7	73.4	80.0	90	71	83	76	85.1	85.9	6.68	169.7	2.90	11	10	1			192.15	6.20	50
Mount Faber, Singapore ...	88.1	75.0	81.5	93	71	80	79	82.7	83.3	4.73	120.1	1.48	14	12				177.00	5.71	47
Butterworth, Province Wellesley ...	87.3	73.9	80.6	90	72	80	77	84.6	85.8	8.77	222.8	1.80	18	14	2			187.75	6.06	49
Bukit China, Malacca ...	84.7	73.6	79.1	87	71	81	80	82.6	84.3	11.59	294.4	2.64	21	17	5			166.85	5.38	44
Kluang, Johore ...	86.6	71.4	79.0	90	68	82	73	81.5	82.4	4.51	114.6	1.01	20	13		10	1	158.05	5.10	42
Bukit Lalang, Mersing, Johore	86.9	71.9	79.3	89	69	79	73	81.5	82.3	5.77	146.6	1.33	18	14	3	2		173.40	5.59	46
Alor Star, Kedah ...	87.2	74.1	80.7	90	72	79	76	85.6	86.1	8.70	221.0	2.59	19	15	3		1	178.60	5.76	46
Kota Bahru, Kelantan ...	89.2	73.4	81.3	93	70	86	76	84.5	85.2	6.35	161.3	1.89	13	9	3			197.55	6.37	51
Kuala Trengganu, Trengganu	88.4	72.6	80.5	91	70	85	75	83.2	84.8	8.82	224.0	1.77	17	16	3	1		210.20	6.78	55
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. Pahang ...	74.3	62.9	68.6	78	61	70	65	71.0	72.0	4.84	122.9	1.76	21	16	2	5		154.30	4.98	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.2	56.8	64.5	75	52	68	61	69.9	69.8	5.06	128.5	0.71	24	24	1			132.65	4.28	35
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.0	59.0	65.0	74	57	66	60			5.02	127.5	0.81	24	23		1		137.45	4.43	36

Compiled from Returns supplied by the Meteorological Branch, Malaya.

*This Station has been dismantled.